# INSTALLATION RESTORATION PROGRAM
# PHASE I: RECORDS SEARCH
# BUCKLEY AIR NATIONAL GUARD BASE
# AURORA, COLORADO



Prepared for

Buckley Air National Guard Base
Aurora, Colorado



By

Simons, Li & Associates, Inc.
P.O. Box 1816
Fort Collins, Colorado 80522

August 31, 1982

This report has been prepared for the Air National Guard by Simons, Li & Associates, Inc. for the purpose of aiding in the implementation of the Air National Guard Installation Restoration Program. It is not an endorsement of any product. The views expressed herein are those of the contractor and do not necessarily reflect the official views of the publishing agency, the Air National Guard, or the Department of Defense.

TABLE OF CONTENTS

LIST OF FIGURES

## EXECUTIVE SUMMARY

The Department of Defense (DOD) has developed a program to identify and evaluate past hazardous material sites on DOD property, to control the migration of hazardous contaminants, and to control hazards to health or welfare that may result from these past disposal operations. This program is called the Installation Restoration Program (IRP). The IRP has four phases consisting of Phase I, Initial Assessment/Records Search; Phase II, Problem Confirmation; Phase III, Technology Base Development; and Phase IV, Operations. Simons, Li & Associates, Inc. (SLA) was retained by the Air National Guard to conduct the Phase I, Initial Assessment/Records Search at Buckley Air National Guard Base under Contract No. DAHA05 82 C 0006.

### INSTALLATION DESCRIPTION

Buckley ANGB is located in Aurora, Colorado. Buckley was activated in 1942 and has operated under Army, Navy, and Air National Guard command. The primary mission of the base is to train Air National Guard personnel.

### ENVIRONMENTAL SETTING

The environmental setting data reviewed for this study indicate the following key items concerning the impact of past waste disposal practices on the base:

- Surficial soils at Buckley ANGB are predominantly clay and silt loams. These soils have low to moderate permeabilities and are relatively erodible.
- The Denver Aquifer lies at or near the ground surface. The ground water is used for domestic and irrigation purposes. The upper section of the aquifer is unsaturated.
- No rare or endangered species of plants or wildlife are found at Buckley ANGB.
- Precipitation is about 14 inches per year and annual evaporation and transpiration is between 40 and 50 inches.

### METHODOLOGY

During the course of this project, interviews were conducted with those past and present base personnel familiar with past waste disposal practices. File searches were performed for facilities which have generated, handled,

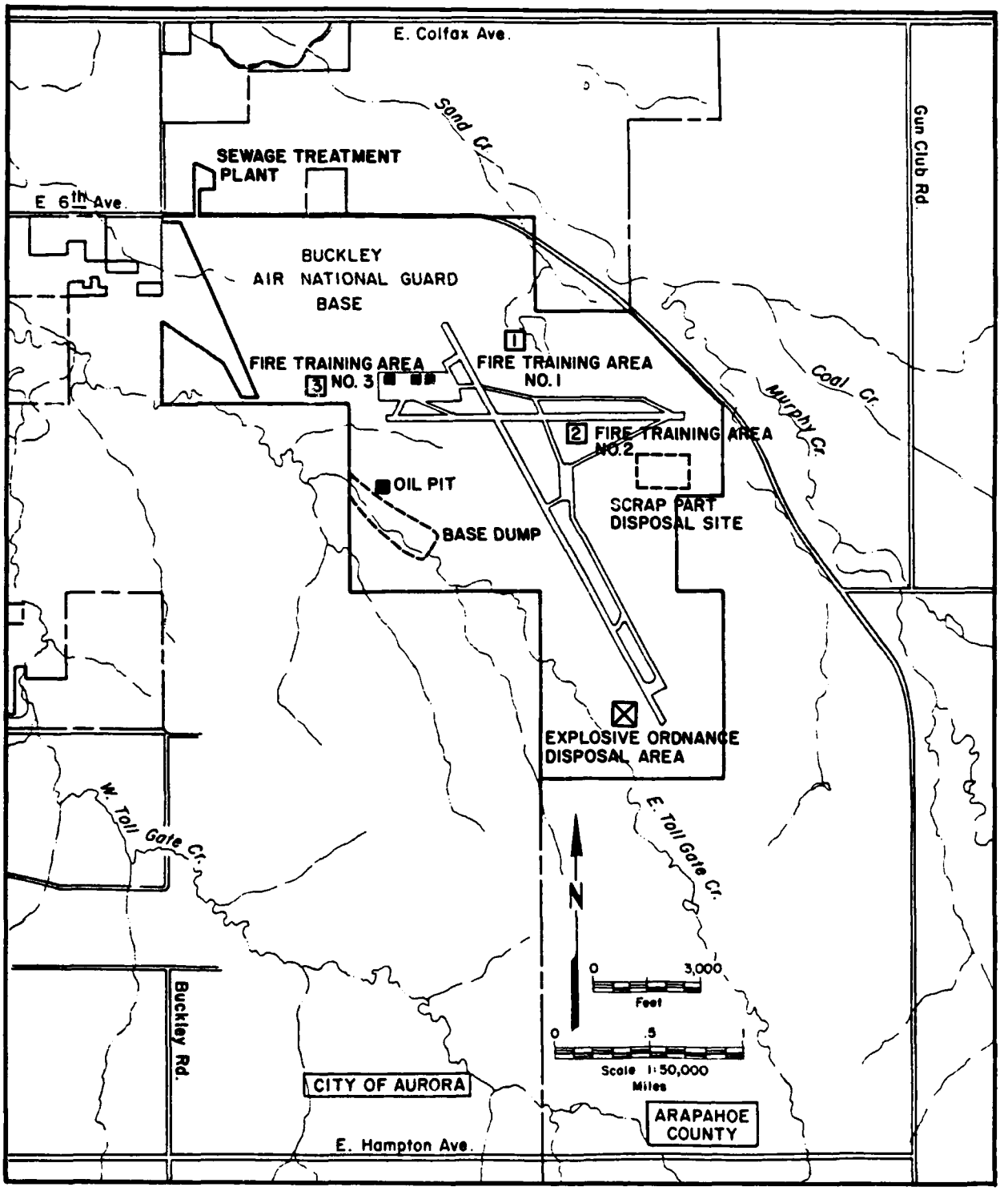



FIGURE I. POTENTIAL SITES FOR CONTAMINANT MIGRATION

## RECOMMENDATIONS

The detailed recommendations developed for further assessment of potential contaminant migration are presented in Chapter VI. These recommendations are summarized as follows:

- Fire Training Area No. 2: Obtain soil borings in and around the area. Analyze samples to determine level of contamination.
- Oil Pit: Analyze contents and obtain soil borings.
- Base Dump: Obtain soil borings and collect sediment and runoff samples from East Toll Gate Creek.
- Fire Training Area No. 3: Obtain soil borings in and around the area.
- Fire Training Area No. 1: Obtain soil borings in and around the area.
- Storm Drainage System at Building 801: Collect and analyze sediment and runoff samples from drainage system.

# CHAPTER I

# INTRODUCTION

# CHAPTER I

# INTRODUCTION

## BACKGROUND

The Air National Guard has in the past been engaged in a variety of operations dealing with hazardous materials. Federal, state and local governments have developed strict regulations to require that disposers identify the locations and contents of disposal sites and take action to eliminate hazards in an environmentally responsible manner. The Department of Defense (DOD) has issued a Defense Environmental Quality Program Policy Memorandum which requires the identification and evaluation of past hazardous material disposal sites on DOD property, the control of migration of hazardous contaminants, and the control of hazards to health or welfare that resulted from these past operations. This program is called the Installation Restoration Program (IRP). The IRP will be a basis for response actions on Air Force Installations under the provisions of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980.

## PURPOSE AND SCOPE OF THE ASSESSMENT

The Installation Restoration Program has been developed as a four-phased program as follows:

Phase I - Initial Assessment/Records Search

Phase II - Problem Confirmation

Phase III - Technology Base Development

Phase IV - Operations

Simons, Li & Associates, Inc. (SLA) was retained by the Air National Guard to conduct the Phase I Records Search at Buckley Air National Guard Base (ANGB) under Contract No. DAHA05 82 C 0006. This report contains a summary and an evaluation of the information collected during Phase I of the IRP.

The goal of the first phase of the program was to identify the potential for environmental contamination from past waste disposal practices at Buckley ANGB, and to assess the potential for contaminant migration. The activities undertaken in Phase I included the following:

- Review site records

- Interview personnel familiar with past generation and disposal activities
- Inventory hazardous materials
- Determine quantities and locations of current and past hazardous waste storage, treatment, and disposal
- Define the environmental setting at the base
- Review past disposal practices and methods
- Conduct field inspection
- Gather pertinent information from federal, state, and local agencies
- Assess potential for contaminant migration

In order to perform the on-site portion of the records search phase, SLA assembled the following core team of professionals:

Ruh-Ming Li, Ph.D., Project Reviewer

Kenneth G. Eggert, Ph.D., Project Manager

Thomas P. Ballestero, Ph.D., Senior Hydrologist

Thomas C. Fairley, Project Engineer

Walter W. Melvin, Jr., M.D., Ph.D., Toxicologist

## METHODOLOGY

The methodology utilized in the Buckley ANGB records search began with a review of past and present operations conducted at the base. Information was obtained from available records and interviews with past and present base employees from various operating areas of the base. Those interviewed included personnel associated with wastewater treatment, pesticide operations, fuel storage and dispensing, aircraft maintenance, and other base activities. Personnel from tenant organizations were also interviewed.

Federal, state, and local agencies were also contacted and interviewed for pertinent base-related environmental data. The agencies contacted are listed in Appendix B.

The next step in the activity review was to determine the past management practices regarding the use, storage, treatment, and disposal of hazardous materials from the various operations on the base. This portion of the review included the identification of all known past disposal sites and any other possible sources of contamination, such as fuel-saturated areas around the fire training areas. A helicopter overflight and ground tour of the identified sites were then made by the SLA project team to gather site-specific information.

A decision was then made, based upon all of the above information and utilizing the decision tree shown in Figure 4.1, concerning the existence of potential for hazardous material contamination at any of the identified sites. For those sites where a potential for contamination was identified, a determination of the potential for migration of the contamination was made by considering site-specific conditions. If no potential exists, the site was deleted from further consideration.

If the potential for contaminant migration was considered significant, the site was evaluated and prioritized using the hazardous assessment rating methodology (HARM). The HARM score indicates the relative potential for contaminant migration at each site. For those sites showing a high potential, recommendations are made to quantify the potential contaminant migration problem under Phase II of the Installation Restoration Program. For those sites showing a moderate potential, a limited Phase II program may be recommended to confirm that a contaminant migration problem does or does not exist. For those sites showing a low potential, no further follow up Phase II work is recommended.

# CHAPTER II

# INSTALLATION DESCRIPTION

# CHAPTER II

# INSTALLATION DESCRIPTION

## LOCATION, SIZE, AND BOUNDARIES

Buckley ANGB is located in Aurora, Colorado (Figures 2.1, 2.2, and 2.3). The base covers 3,540 acres in the Sand Creek and East Toll Gate Creek drainage basins. Present land usage adjacent to the base is as follows:

North - Industrial and agricultural

West - Commercial and residential

South - Residential and agricultural

East - Agricultural

## BASE HISTORY

The land areas now known as Buckley Air National Guard Base are the remainder of a parcel of 5,740 acres which the Federal Government purchased in 1942-43 primarily to train bombardiers and armorers for the U.S. Army Air Corps. Original cost of construction was about 15 million dollars. In Buckley's peak year of operation, 35,000 students graduated from various training courses. As World War II ended, the activities and population at Buckley decreased to about 7,500 personnel in 1946.

Buckley Field was placed in inactive status in July of 1946 and transferred to the State of Colorado. Units of the Colorado Air National Guard occupied the field in an inactive training status. In 1947, the U.S. Navy assumed jurisdiction over the field, with a portion still permitted to, and under control of the Colorado Air National Guard. Buckley was then known as Naval Air Station-Denver, Colorado. This arrangement continued until May 1959, when the U.S. Navy deactivated the station. Concurrently, it was licensed to the State of Colorado and was designated Buckley Air National Guard Base. Buckley has been under Colorado Air National Guard command and control since that time.

The airfield complex consists of two runways of 11,000 feet and 8,000 feet. All structures are categorized as either operations, maintenance or

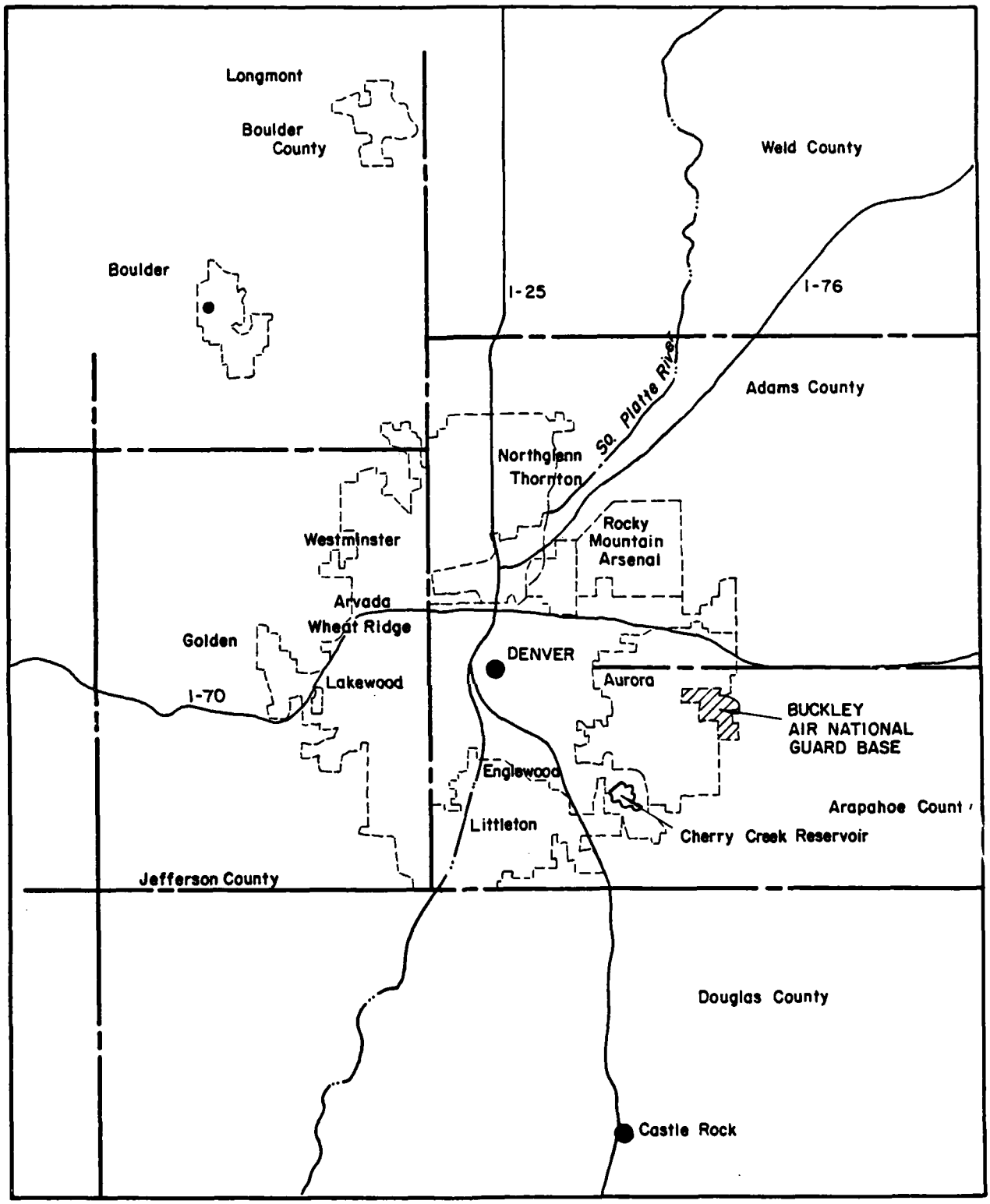



FIGURE 2.2. AREA LOCATION MAP

training facilities. The base has few community facilities. All facilities are fully occupied and in use.

Further details of the history of Buckley ANGB are included in Appendix C.

## MISSION

Buckley ANGB has three distinct missions. The base provides the site for training to combat readiness of tactical units of the Colorado Air National Guard; it is the only military air base in the Denver metropolitan area and supports aircraft of all commands and services around the clock; and it provides support for numerous Department of Defense tenant activities assigned to the base. As the only military flying base in the area, Buckley is also charged with certain responsibilities related to aircraft search and crash response within the geographical area. In addition to supporting over 60 base assigned aircraft, the base also supports up to 10,000 transient military aircraft per year.

## ORGANIZATION

Assigned Units/Activities at Buckley ANGB include the following:

COLORADO AIR NATIONAL GUARD:

- Detachment 1, Headquarters, Colorado ANG (Host)
- 140th Tactical Fighter Wing and Assigned Units
- 154th Tactical Control Group

TENANTS:

- Det 3, SAMSO (Aerospace Data Facility) (AFSC)
- 2nd Comm Sq (Aerospace Data Facility) (SAC)
- Det 3, 375th Aeromedical Airlift Wing (MAC)
- Det 29, 15th Weather Squadron (MAC)
- 1987th Communications Squadron (FF) (AFCS)
- Marine Air Reserve Training Unit
- Naval Air Reserve Training Detachment
- Colorado Army National Guard
  - 19th Special Forces Group (AB)
  - 147th Medical Hospital
  - 1157th Aviation Company (Attack Helicopter)
  - Army Aviation Support Facility

# CHAPTER III

# ENVIRONMENTAL SETTING

# CHAPTER III

# ENVIRONMENTAL SETTING

The environmental setting of Buckley ANGB is described in this chapter with the primary emphasis directed toward identifying features that affect the movement of hazardous waste contaminants.

## METEOROLOGY

The climate of the Buckley ANGB area is characteristic of Colorado high plains areas. Typically, this area experiences cold, dry winters and relatively cool, dry summers. Low humidity and low precipitation rates, extreme fluctuations in daily and seasonal temperatures and occasional high winds are normal for this semi-arid, continental-type climate. Air masses from at least four sources influence Buckley's weather; Artic air from Canada and Alaska, warm, moist air from the Gulf of Mexico, warm, dry air from the Southwest, and Pacific air modified by its passage over the Coastal, Sierra Nevada and Rocky Mountain Ranges to the west.

Temperatures reach 90°F 33 times per year on an average, but reach 100°F only once in five years. Average monthly temperatures range from 29.9°F in January to 73°F in July (see Table 3.1). The all-time record high temperature is 105°F and the record low is -30°F.

Precipitation averages 14.5 inches per year including an average of 59.6 inches of snow per year. Spring is the wettest, cloudiest, and windiest season. Precipitation accounting for 37 percent of the yearly total falls as snow or rain in the spring months. Summer precipitation is generally in the form of scattered local thunderstorms and accounts for 32 percent of the yearly total. Autumn has a greater percentage of sunny weather than any other season and winter has the least precipitation (11 percent) of the yearly total. Periods of severe winter weather are generally brief. The highest recorded yearly precipitation is 23.31 inches and the low is 7.51 inches. The highest recorded sustained wind speed is 65 mph with gusts occasionally exceeding 100 mph. The average pan evaporation rate is about 50 inches per year. The average evapotranspiration rate is estimated to be between 40 and 50 inches per year, depending on the type of vegetative cover. A summary of meteorological data is given in Table 3.1.

## GEOGRAPHY

Buckley ANGB lies within the Colorado high plains area. The area is characterized by rolling hills and relatively steep drainageways.

### Topography

Buckley ANGB is situated on high ground dividing the Sand Creek and Toll Gate Creek drainage basins. The ground surface elevation of the base ranges from 5,700 feet mean sea level (MSL) at the southeast corner to 5,480 feet MSL at the northwest corner. The overall ground slope is one percent to the northwest.

### Drainage

Drainage of Buckley ANGB is accomplished by overland flow to drainage channels which lead either to Sand Creek or Toll Gate Creek (Figure 3.1). East Toll Gate Creek is an intermittent stream which crosses the southwest corner of the base. Sand Creek sustains a small base flow throughout most of the year. East Toll Gate Creek is a tributary of Sand Creek, and Sand Creek is a tributary of the South Platte River. Both Sand Creek and East Toll Gate Creek have sand-bed channels. In sand-bed streams, the bed material is easily eroded and is continually moved and reshaped by the flow, and therefore, during large flows, lateral migration, bank sloughing, and degradation can occur.

### Soils

Three major soil associations have been identified at Buckley ANGB. These are (1) Alluvial land-Nunn association; (2) Renohill-Buick-Litle association; and (3) Fondis-Weld association. Alluvial land-Nunn soils are found along Sand Creek and consist of deep, loamy, and sandy soils. The Renohill-Buick-Litle (RBL) association is found on the East Toll Gate Creek uplands. The RBL association is moderately deep and has a loamy to clayey texture. The Fondis-Weld association is formed mainly in silty, wind-deposited materials and is found in the level areas at Buckley ANGB. The Fondis-Weld association typically contains a clayey layer in the subsoil. Rock outcrops are found at Buckley ANGB, predominantly near the runways. A total of 15 soil series have been identified at Buckley ANGB by the USDA Soil

Conservation Service. Most of the soil series have been classified as moderately to highly erodible.

## GEOLOGY

Buckley ANGB lies within the Denver geological basin. The location of the Denver basin is shown in Figure 3.2. Generalized cross sections of the basin are shown in Figure 3.3 and summarized in Table 3.2. The surficial geology of the Buckley ANGB area is shown in Figure 3.4 and described in Table 3.3.

Geologic data specific to Buckley ANGB were obtained from logs of water wells near the base. Typical cross sections are shown in Figure 3.5.

## GROUNDWATER

Buckley ANG Base lies within the Denver groundwater basin. The principal aquifers underlying the area are, in descending order, the Denver Formation of Late Cretaceous and Early Tertiary Age and the Arapahoe, Laramie and Fox Hills Formations of Late Cretaceous Age. The Pierre Shale of Late Cretaceous Age, because of its great thickness (5,000 to 7,000 feet) is considered to be the base of the major bedrock system.

The Denver Formation consists of a 600- to 1,000-foot thick series of interbedded shale, claystone, siltstone, and sandstone in which coal and fossilized plant remains are common. The water-bearing layers of sandstone and siltstone occur in poorly-defined irregular beds that are dispersed within relatively thick sequences of claystone and shale. Individual sandstone and siltstone layers are commonly lens-shaped and range in thickness from a few inches to as much as 50 feet. Water-bearing layers penetrated by a well may be of different thicknesses or be absent in an adjacent well because of this lens-shaped layering. Figure 3.6 contains a typical well log for the Buckley area. The sandstone and siltstone generally are only moderately consolidated and are coarser than the claystone and shale, allowing groundwater to flow through the void spaces between the grains of sand and silt, while little water is able to flow through the claystone and shale. The total thickness of the water-bearing layers is about 175 feet in the Buckley area. The Denver Aquifer thus consists of a complex pattern of interconnected beds of permeable and relatively impermeable sediments that differ in their ability to store and transmit water from one area to another.

Table 3.2 continued.

| Era | System or Period | Series | Geologic Unit | Representative Thickness (feet) | Physical Character | Water Supply |
|---|---|---|---|---|---|---|
| | | Upper Cretaceous | Arapahoe Formation | 400-1,400 | White to yellow arkosic sand, gravel, and conglomerate interbedded with gray and green and red shale and clay. Sand, gravel, and conglomerate beds are thicker, more numerous, and more persistent than the upper part. The thickest and most extensive zones of coarse sediments are in the upper 700 feet of this part of the formation. The beds of coarse sediments become progressively thicker and more numerous toward the southwest part of the basin. In the Denver area two persistent zones of coarse materials are recognized; in this report these are referred to as the middle conglomerate and the lower conglomerate. Each of these conglomerate zones ranges in average thickness from 50 to 200 feet. The two conglomerate zones are separated by 50 to 200 feet of shale, siltstone, and silty sandstone. | Yields moderate quantities of water except near outcrops or where effected by local faulting or folding. Water is generally of good quality, is fairly soft, and has fairly low concentrations of dissolved solids. |
| | | | | 400-600 | Blue-gray silty shale; contains thick silty sandstone, limestone, and lignite beds. Sandstone beds generally lenticular except near bottom of the unit. Coal beds scattered throughout the formation, but the thickest and most persistent coal beds are in the lower half. | Yields very small quantities of water of poor quality. Contains much hydrogen sulfide, iron, and methane. |

Table 3.2 continued.

| Era | System or Period | Series | Geologic Unit | Representative Thickness (feet) | Physical Character | Water Supply |
|---|---|---|---|---|---|---|
| Mesozoic | Cretaceous | Lower Cretaceous | Pierre Shale | 5,000-7,500 | Gray, blue, and black shale, sandy shale, and locally silty sandstone, with thin limestone lenses and bentonitic seams. | Generally yields no water except for very small quantities of highly mineralized water near outcrops. In some places potable water obtained from fractured or weathered zones or from sandstone lenses near their outcrops. |
| | | | Niobrara Formation | 300 | Black to gray calcareous shale, gray to greenish-white limestone and white chalky marl. | Fractured limestone locally will yield very small quantities of rather highly mineralized water. |
| | | | Benton Shale | 500 | Black brittle shale, persistent bentonite seams, chalky limestone, and thin sandstone near top. | Fractured shale near outcrop yields very small to small quantities of highly mineralized water. |
| | | | Dakota Group<br>South Platte Formation | 100 | Gray-white fine- to medium-grained friable to firm sandstone; thin bedded to massive, ripple marked; forms hogbacks. | Yields small to moderate quantities of water near outcrop areas. Water locally contains excessive iron. |
| | | | | 150 | Dark-gray silty carbonaceous shale, locally fossiliferous; contains fire clay. | Yields no water. |
| | | | Lytle Formation | 60 | Gray coarse-grained sandstone; locally conglomeratic and crossbedded. | Yields small to moderate quantities of water in and near outcrop. |
| | | | Morrison Formation | 300 | Varicolored silty sandstone, marlstone, limestone, red silty mudstone, and local gypsum beds. Purple, red, gray, greenish gray, green, and yellow colors common. | Not developed as an aquifer. Basal sandstone bed might yield small quantities of water close to outcrops. |

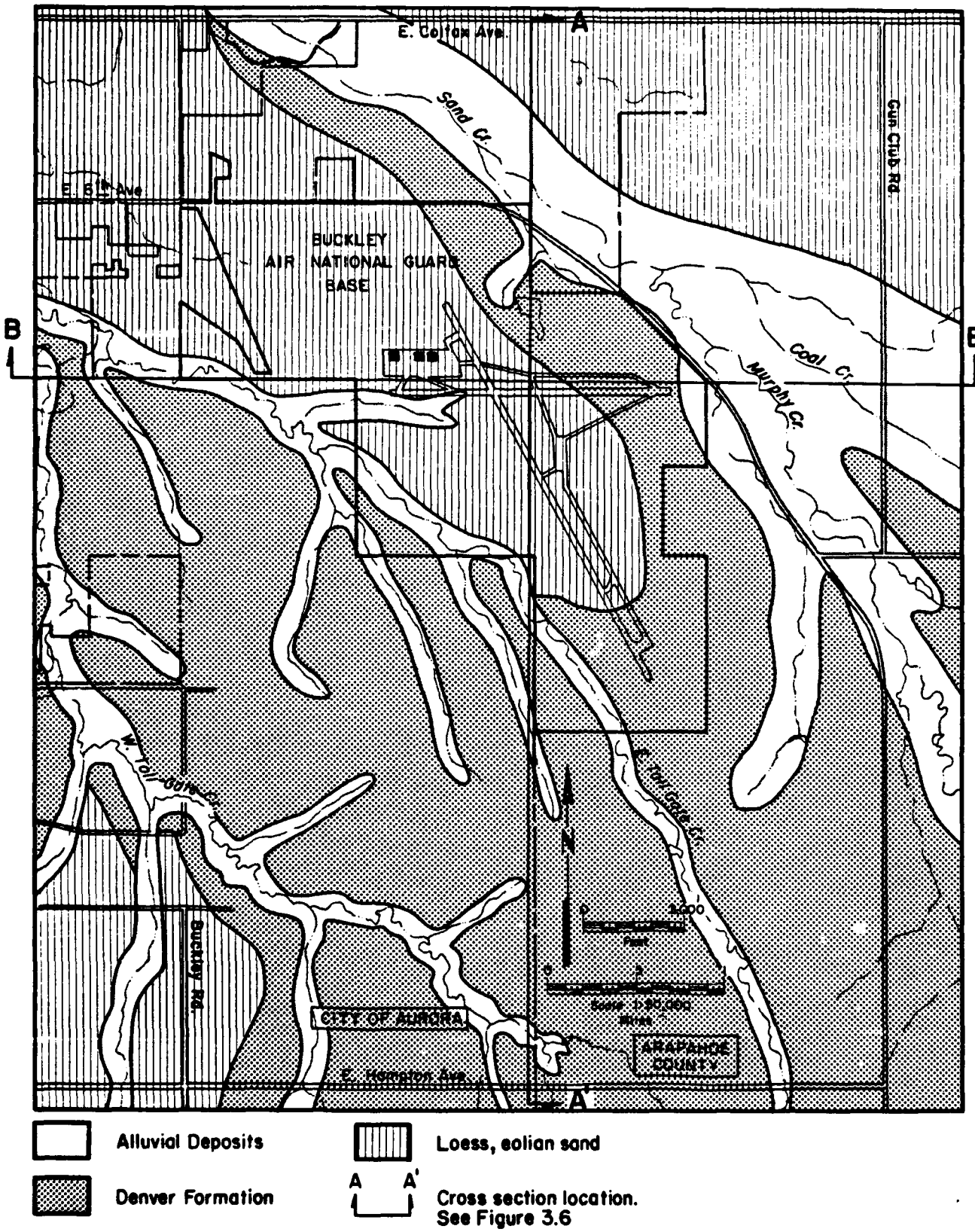
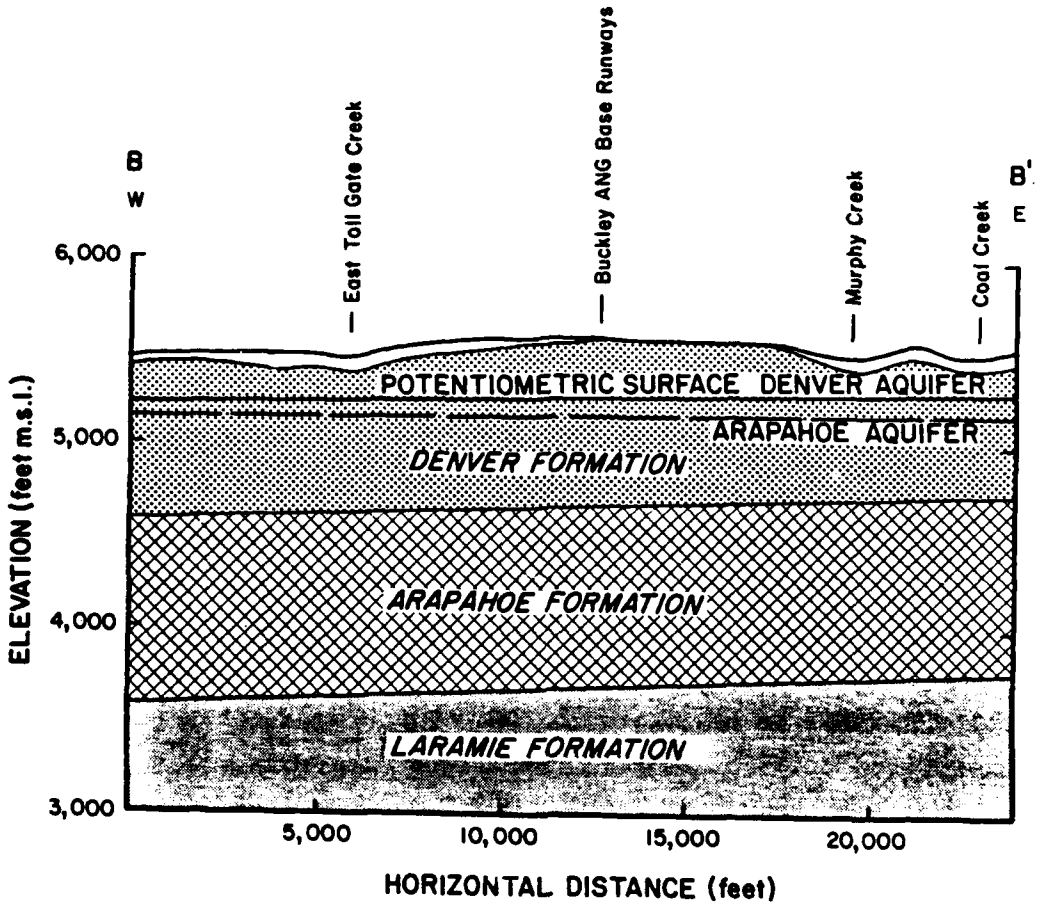



FIGURE 3.4. SURFICIAL GEOLOGY AT BUCKLEY ANG BASE

Table 3.3. Description of Surface Geology.

| Category | | Geologic Unit |
|---|---|---|
| Alluvial Deposits | Post-Piney Creek Alluvium | Mostly reworked fairly clean sand and gravel in modern flood plains. Overlain in places by a few feet of dark humus-rich sandy silt |
| | Piney Creek Alluvium | Well-stratified clay, silt, and sand; contains thin lenses of sand and fine gravel. Forms low terraces about 10 to 25 feet above present stream beds and fills shallow upland valleys. Locally very calcareous |
| | Broadway Alluvium | Pebbly well-bedded well-sorted granitic gravel. Forms terraces about 25 to 40 feet above stream beds. Pebbles mostly less than 1 inch in diameter. |
| | Louviers Alluvium | Granitic coarse gravel; contains abundant cobbles, which form thick beds along the principal valleys. Pebbly alluvium with cobble layers near base and deformed silt layers in upper part. In many places stained with iron and manganese. |
| Windblown Deposits | Eolian sand | Very fine to coarse poorly sorted sand and silt. Forms extensive sand hills, which are generally stabilized. |
| | Younger loess | Windblown massive, compact silt with some sand lenses. In part reworked by water. Forms vertical cut banks. |
| Denver Formation | | 600 to 1,000 foot thick series of interbedded shale, claystone, siltstone and sandstone in which coal and fossilized plant remains are common. Distinguishing characteristics of the formation are its olive, green-gray brown, and tan colors; the presence of coal; and a preponderance of shale and claystone with respect to other rock types. The predominant olive and green-gray colors in the formation are due to the presence of sediments derived from erosion of basaltic and andesitic lavas and distinguish Denver rocks from the generally lighter colored rocks found in the overlying Dawson Arkose and the underlying Arapahoe Formation. In most of the outcrop area along the margins of the aquifer, the formation is exposed at the surface or buried under a thin layer of soil. In other parts of this area, the formation is buried under 10 to 100 feet of sand and gravel deposited in the valleys of the South Platte River and many of the smaller streams crossing the area. |




For cross section location see Figure 3.4.

FIGURE 3.5. CONT.

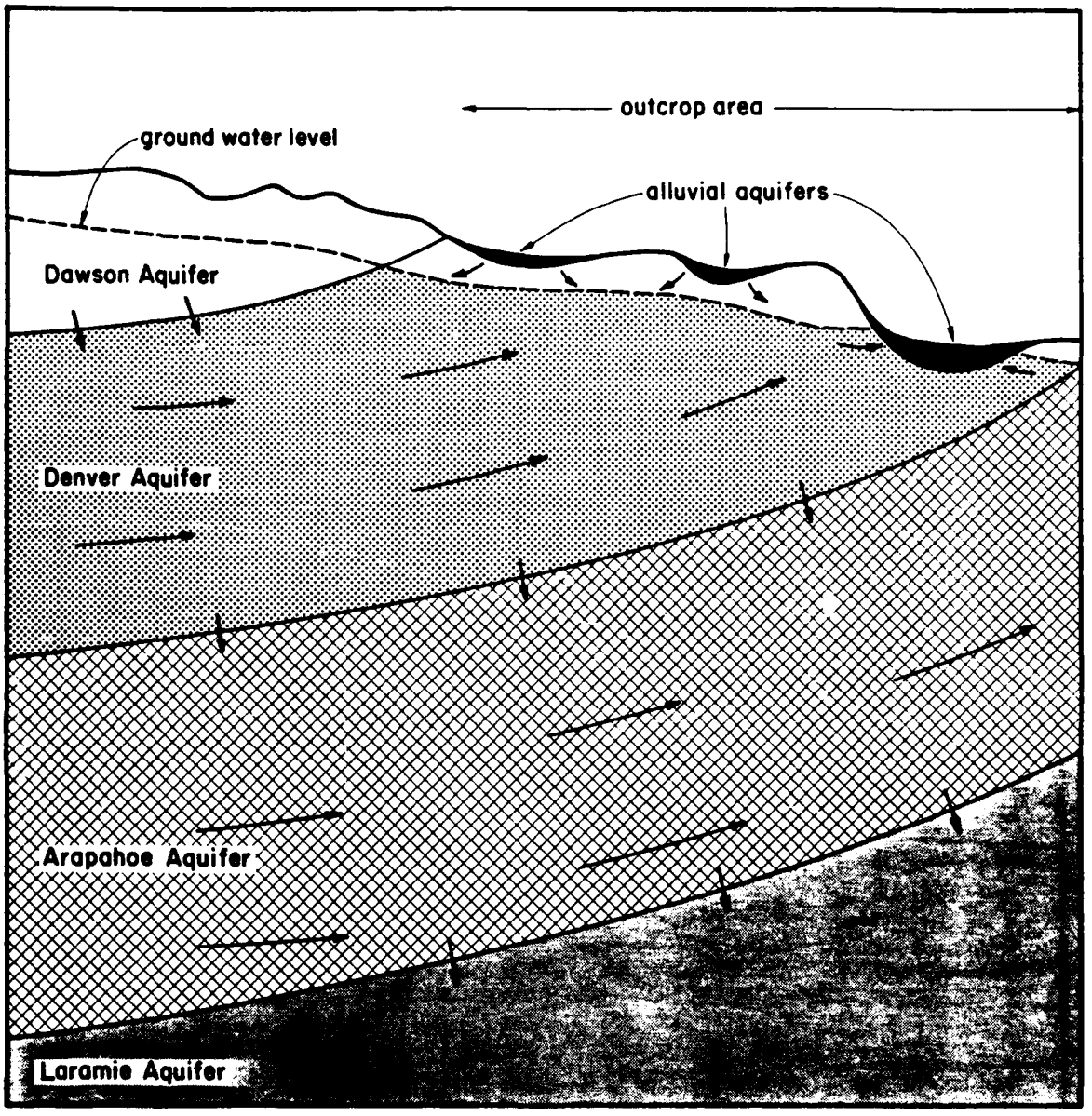
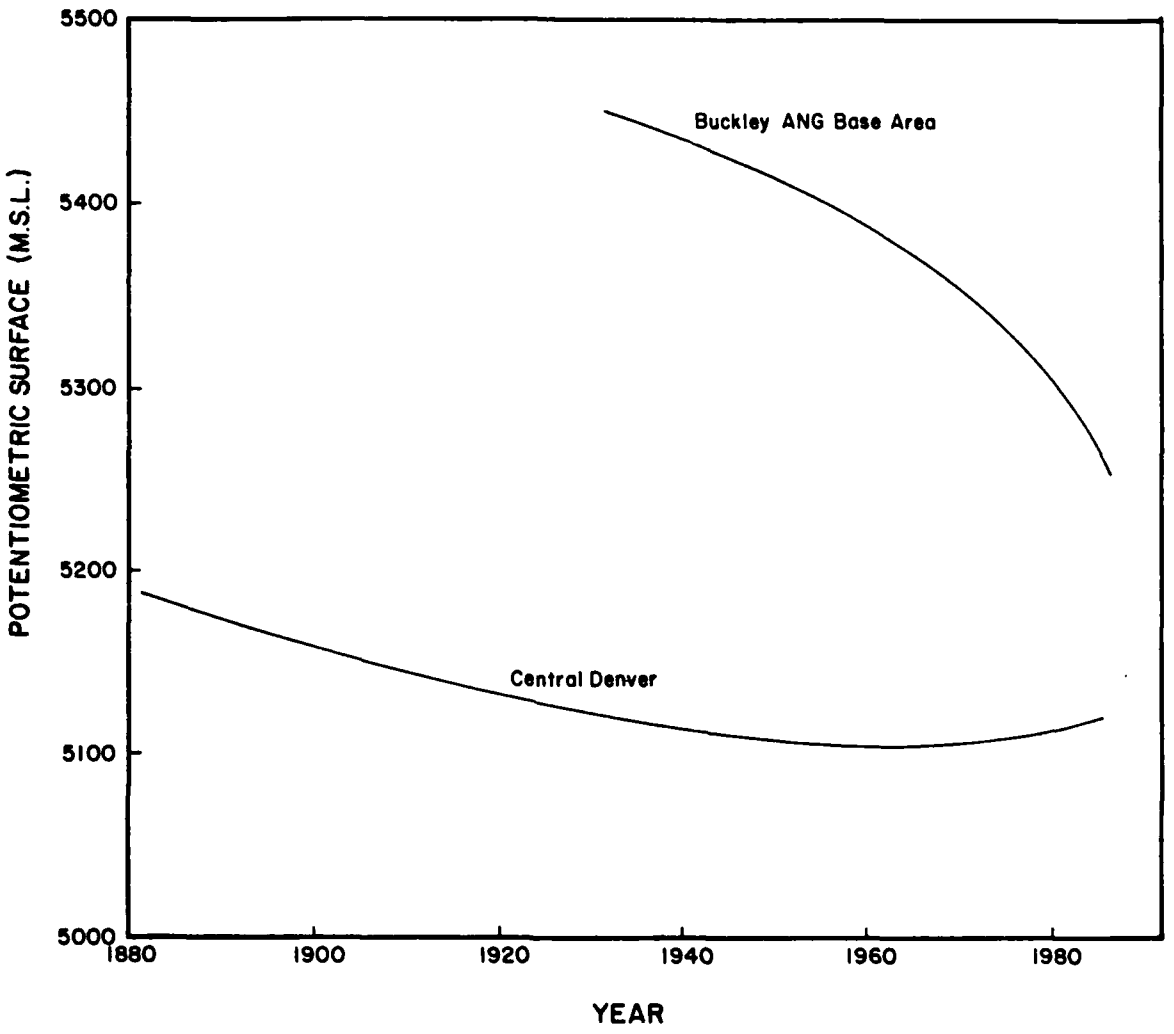



FIGURE 3.7. DIAGRAM OF GROUND WATER FLOW (ADAPTED FROM ROBSON AND ROMERO, 1981).




Source: Robson and Romero (1981)
Emmons (1896)

FIGURE 3.9. WATER LEVEL CHANGE IN THE DENVER AQUIFER

within the historical range of the black-footed ferret, Mustela nigripes, but no sightings have been recorded at or near Buckley in over 15 years.

The majority of Buckley ANGB is prairie grassland. Native species include Big and Little Bluestem, Buffalo and Gramma grasses. The only native trees are plains cottonwood and some willows. Many introduced species exist at Buckley, including Bluegrass and Elm Trees. A more detailed description of biota is included in Appendix D.

# CHAPTER IV

# FINDINGS

# CHAPTER IV

# FINDINGS

To assess hazardous material/waste management at Buckley ANGB, material/waste generation and disposal methods were reviewed. This chapter summarizes the hazardous material/waste generated by activity, describes disposal methods, identifies the disposal sites located on the base, and evaluates the potential for contaminant migration. Figure 4.1 presents the decision-tree methodology used in the review of waste practices. The methodology provides a logical algorithm for the consistent evaluation of all base practices.

## PAST SHOP AND BASE ACTIVITY REVIEW

To identify base activities that have resulted in generation and disposal of hazardous waste or materials, a review of current and past material/waste generation and disposal methods was conducted. This review consisted of interviews with base employees, a search of files and records, and site inspections.

The sources of most hazardous wastes that are generated on Buckley ANGB can be associated with one of the following activities:

- Maintenance shops
- Fire control utilization
- Pesticide utilization
- Fuels management

The following discussion addresses only those wastes generated on the base which are either hazardous or potentially hazardous. In this discussion, the term hazardous waste is used as it is defined by Resource Conservation and Recovery Act of 1976 (RCRA) or by the Buckley ANGB documents which have been reviewed. A potentially hazardous waste is one which is suspected of being hazardous although insufficient data are available to fully characterize the waste material.

Activities at Buckley ANGB include aircraft and ground-vehicle maintenance, fuel storage and dispensing, operation of utility systems, and general base maintenance activities. The shop records of the Environmental

Health Officer were reviewed and interviews were conducted with personnel familiar with the various activities in order to assess hazardous waste generation and disposal practices. A summary of hazardous material usage and disposal practices is given in Table 4.1.

140th Tactical Fighter Wing

The 140th Tactical Fighter Wing performs all types of aircraft maintenance on the A-7 aircraft stationed at Buckley ANGB. Maintenance operations generate waste in the form of waste solvents, contaminated fuels and hydraulic fluids, degreasers, dye penetrants, and other associated materials. Solvents used at Buckley ANGB include PD-680, 1,1,1-Trichloethane, methyl ethyl ketone, and acetone. Trichloethylene and possibly other chlorinated hydrocarbons were used in the past. Avionic and instrument repair is generally limited to switching component parts. No electroplating is conducted at Buckley ANGB, nor were any records found to indicate any electroplating operations in the past. The 140th Tactical Fighter Wing currently flies A-7 aircraft and in the past has flown F-100, F-86, F-84, and P-51 aircraft. Maintenance activities for the jet aircraft are essentially the same. No records were found to indicate specific types of hazardous materials used and interviews did not reveal any substantial differences from current practices. Fuel cell repairs are done in Building 800, as is spot painting of aircraft, general corrosion control, and stripping. De-icing is generally done in Building 800, but is occasionally done on the ramp area. Painting operations involve the use of strippers such as toluene. Phenolic paint strippers were used in the past. Zinc chromate primers are used and paints include lacquers and polyurethane paint.

Currently, all solvents, used oils, and other fluids associated with aircraft maintenance are stored in portable storage tanks and turned into Supply for disposal through the Defense Property Disposal Office (DPDO) in Fort Carson. Small spills are either washed to the storm drainage system in the area of Building 801 or treated with absorbent materials and swept up. No major spills of solvents, oil, or other fluids were reported. JP-4 contaminated with water is transferred to the fire department for use in training exercises.

Table 4.1 continued.

| Shop Name | Location (Bldg. No.) | Waste Material | Waste Quantity* | Disposal Methods 1950---------1960---------1970---------1980---- |
|---|---|---|---|---|
| | | Methyl Ethyl Ketone (MEK) | 50 gal/month | |
| | | Epoxy primer | 8 gal/month | |
| | | Lacquer thinner | 6 gal/month | |
| | | Toluene | 1 gal/month | Waste oil holding tank → |
| | | Polyurethane | 18 gal/month | |
| | | Lacquers | 4 gal/month | |
| | | Enamels | 1/2 gal/month | |
| | | Acetone | 5 gal/month | |
| Electrical/ Environmental Shop | 801 | Strippers | | |
| | | Cleaners | 2 gal/month | Waste oil holding tank → |
| Non-Destructive Inspection | 801 | Zyglow | 2 gal/month | Fire Dept / Roads & Grounds ← Waste oil holding tank → |
| | | Engine oil | 5 gal/month | |
| | | Developer, aqueous | 1 gal/month | Flushed to sanitary sewer → |
| | | Fixer | 1 gal/month | Flushed to sanitary sewer → Reclaimed → |
| | | Magnetic Inspection compound (spray) | 4 can/month | Base Dump → Contractor → |
| | | Penetrants | 10 gal/month | Recycled → |
| | | Developer, non-aqueous | 20 can/month | Base Dump → Contractor → |

Table 4.1 continued.

| Shop Name | Location (Bldg. No.) | Waste Material | Waste Quantity* | Disposal Methods 1950---------1960---------1970---------1980---- |
|---|---|---|---|---|
| Aircraft Engine Shop/Test Cell | 960 | JP-4 | 100 gal/month | |
| | | Synthetic oil | 10 gal/month | |
| | | PD-680 | 20 gal/month | |
| | | MEK | 1 gal/month | |
| | | Carbon removing Compound | 5 gal/month | Fire Dept / Roads & Grounds → Waste oil holding tank → |
| | | Xylene | 5 gal/month | |
| | | Paint remover | 1 gal/month | |
| | | Lacquer | 12 can/month | Base Dump → Contractor → |
| Structural Repair | 801 | Toluene MEK Lacquer thinner | 1 gal/month | → Waste oil holding tank → |
| | | Acid cleaner | 1 gal/month | → Neutralize and flush to sanitary sewer → |
| Transient Aircraft Maintenance | 909 | PD-680 | 40 gal/month | |
| | | JP-4 | 50 gal/month | Fire Dept / Roads & Grounds → Waste oil holding tank → |
| | | Synthetic oil | 1 gal/month | |
| | | Hydraulic fluid | 1 gal/month | |

Prior to 1981, waste fluids were stored in an underground fuel tank near Building 815. The possible incompatability of the contents led to segregation in drums. The contents of the underground tank were analyzed and found to contain water, solvents, fuels and used oil. The contents will be disposed of by contract. In the past, used solvents, oils, and contaminated fuels were all stored together in the underground tank. The fire department used the contents of the tank for training fires.

It was reported that during the years of Navy operation, the fluids were used to aid in the burning of trash in the base dump. Used oil was also dumped into a pit located southeast of the Civil Engineering shops. The pit is enclosed by concrete walls, but it is not known if the pit is lined at the bottom. The oil pit is currently filled with several feet of what appears to be fresh oil.

Transient Aircraft Maintenance

Transient aircraft maintenance is performed in Building 909. Up to 10,000 aircraft of all types are serviced each year. Maintenance is generally flight-line maintenance and does not include heavy airframe or power plant maintenance, but occasional spot painting is done. A hazard associated with transient F-16 aircraft is the possibility of hydrazine spills. Hydrazine is a powerful oxidizer used in the emergency power units of F-16 aircraft. One incident of a worker coming in contact with hydrazine fumes was reported. Contaminated fuels are turned over to the Fire Department, and hazardous wastes are turned into Supply.

Tenant Aircraft Maintenance

Aircraft maintenance is performed by the U.S. Army Readiness Region VIII and the Marine Reserve on several twin-engine propellor planes in Building 909. Wastes generated are small and limited to the same types of materials used in other aircraft maintenance operations. The Army National Guard operates the Army Aviation Support Facility (AASF) located in Building 1500. Maintenance performed at the AASF includes engine overhauls and airframe maintenance on the helicopters assigned to Company D, 40th Aviation Attack Helicopter Battalion. Hazardous material usage

oil after World War II. The coal storage area was located near Building 549. Fuel oil is stored in four 12,000 gallon underground tanks adjacent to Building 903. Boiler water is acidified prior to heating. Boilers are blown down approximately three times per day. The blowdown water is treated with sodium sulphite, allowed to cool, and discharged to the sanitary sewer system.

Fuels Management

Fuels stored and dispensed at Buckley ANGB include JP-4 jet fuel, No. 2 diesel fuel, avgas 130, and mogas (regular and unleaded). JP-4 is stored in above-ground tanks (Building 200), pumped into tank trucks, and dispensed directly to aircraft. The AASF has its own 15,000 gallon underground storage tank near Building 1500. Avgas 130 is stored in a tank truck and dispensed to aircraft. Diesel fuel is stored near Building 601. Mogas is stored and dispensed at the base gas station, Building 729. Petroleum and synthetic lubricating oils are used in both aircraft and ground vehicles.

An old aquasystem fuel storage tank was located in the vicinity of the present Building 800. Use of this tank was discontinued due to leakage problems. Existing underground storage tanks and fuel lines have not experienced any serious problems with leakage. Fuel spills have involved small quantities and no spill in excess of 100 gallons has occurred, according to base personnel. Fuel spills that cover an area greater than 10 square feet are washed to storm sewers by the fire department. Fuel tanks are cleaned and all sludges taken off the base by outside contractors; however, in the past, fuel tank sludges including avgas sludge were taken to the base dump and spread on the ground. Approximately one ton of sludge every few years was deposited in the base dump from the 1940's until the late 1960's. Filters were also deposited in the dump in this period.

Pesticide Utilization

Pesticides have been used at Buckley ANGB since World War II. Records indicate that DDT was used during the period from 1942 until the late 1950's. Other compounds used included silvex.

Compounds currently used include 2,4-D, Malathion, pyrethrins, and zinc phosphide. Insect control has been contracted for the last five years. Approximately 100 pounds of oats containing two percent zinc phosphide are applied annually for rodent control. 2,4-D is used for weed control and empty

Fire Protection Training

Fire protection training (FPT) activities of the fire department at Buckley ANGB commenced in the 1940's. Since that time, three fire training areas (FTA) have been used as shown in Figure 4.2. FTA No. 1 is located near the abandoned reservoir and was operational during the late 1940's and early 1950's. Avgas was burned at this site. FTA No. 2 is located near the control tower area and was operated from the early 1950's until 1972. Materials burned at this site included avgas and JP-4. FTA No. 3 is located west of Building 801 and operation began in 1972. The procedure is to first add water to the area to reduce infiltration and then add water-contaminated JP-4 and ignite the fuel. The fire is extinguished with water and six percent aqueous film forming foam (AFFF). About 150 gallons of fuel are used during each exercise. Approximately 400 gallons of AFFF are used annually, and about 24 exercises are conducted each year. Fire department personnel estimate that approximately 50 to 70 percent of the fuel is burned during the exercise. Procedures at FTA No. 2 were said to be similar except that a protein-based foam is used.

The contaminated JP-4 is stored in 55-gallon drums adjacent to the fire training area. Only JP-4 is burned during the training exercises, but in the past, flammable materials were obtained from the waste oil holding tank and may have contained motor oil, solvents, and other materials.

All three FTA's are undiked and unlined. Residual materials either evaporate, infiltrate or are washed away by stormwater runoff.

## DESCRIPTION OF PAST ON-SITE DISPOSAL METHODS

The on-site facilities which have been used for management and disposal of waste can be categorized as follows:

- Landfills
- Oil pit
- Sanitary wastewater facilities
- Storm sewer system
- Industrial wastewater treatment
- Ordnance disposal site

These sites are discussed individually below and locations are given in Figure 4.3.

Landfills

The base dump is located adjacent to East Toll Gate Creek near the west installation boundary. The dump has been in operation since 1942. Materials known to have been disposed of in the dump include building materials, paint cans, pesticide containers, scrap paper and other municipal refuse, fuel tank sludges, and construction rubble. Municipal refuse from Buckley ANGB was deposited in the dump from 1942 until about 1968. Municipal refuse from nearby Lowry Air Force Base was disposed of in the dump during the early 1960's. During the period of Navy occupation (1947-1959) and possibly for several years thereafter, the dump was periodically burned to reduce blowing paper and debris. Waste oils and probably other flammable materials were spread on the refuse to aid burning. The method of operation was to dig a trench, fill the trench with waste materials, cover with earth, and dig a new trench.

Many materials are exposed in the dump, including paint and paint cans, empty solvent containers, building materials, and scrap metal. There is also an area where oil/fuel has been dumped, a 55-gallon drum of tar has spilled onto the ground, and construction rubble. Several empty 55-gallon drums have been carried off of the base by flows in East Toll Gate Creek.

The dump extends from the installation boundary on the west to approximately 3,000 feet east along East Toll Gate Creek. Materials have been observed along both banks of the creek. The soils in the area are relatively impermeable, but are subject to erosion. The dump lies within the flood plain of East Toll Gate Creek and the dump has been under water on at least one occasion (1965). Parts of the dump extend into the creek channel as evidenced by materials present in the creek bed. East Toll Gate Creek has high, nearly vertical banks downstream of the base. The channel bed may undergo additional degradation in the future and create additional bank instability. The creek is normally dry and only flows following precipitation events. The groundwater table is variable, but generally is about five feet below the creek bed.

During World War II, the Army disposed of scrap airplane parts in an area east of the control tower. Scrap wing tanks and other parts were placed in this area. In one reported incident, the remains of a crashed aircraft were

buried in this area. A possibility exists that small amounts of low-level radioactive materials could have been deposited at this location. The radioactive materials would be in the form of radium sulfide paints or electron source tubes. No evidence exists to indicate the exact location of this site.

Following World War II, many buildings were salvaged and the foundations bulldozed into excavated pits and covered. Exact locations are unknown, but the sites are not suspected to contain any hazardous materials.

Oil Pit

The oil pit is located adjacent to the base dump southeast of Building 711. The pit is approximately 10 feet square and is enclosed by concrete walls. Standing oil several feet deep is present in the pit, and appears to be recently deposited. It is not known if the bottom of the pit is lined. According to interviews, the contents of the oil pit were occasionally burned in the 1950's. The types of materials disposed of in the pit other than oil are not known. Any oil deposited in the pit is against current base practices.

Waste Water

A wastewater treatment plant was constructed in 1942. It consisted of bar screens, a primary clarifier, a trickling filter, a sludge digester, chlorine contact chambers, and sludge drying beds. The design flow of the plant was approximately one million gallons per day, but actual flows were much less. The treated effluent was discharged to Sand Creek. The sludge drying beds were designed with a filtrate collection system, but the clay tiles comprising the collection system collapsed early in the life of the plant. Sludge accumulation was relatively small and the drying beds were rarely cleaned. The plant was subject to occasional slugs of chemical-type waste.

The sludge-digester roof collapsed in 1978 and the plant was closed. Sanitary wastewater was discharged to the City of Aurora's collection system and treated at the Metropolitan Denver Sewage Disposal District Plant No. 1. City of Aurora personnel have reported that chemical odors are almost always present in the connection to the Buckley ANGB sewer system.

oil and grease are contained in holding tanks which are periodically pumped to 55-gallon drums and sent to Supply for reclamation through DPDO.

## ORDNANCE DISPOSAL SITES

Currently there are no ordnance disposal operations conducted at Buckley. The only weapons used are small arms, and use is confined to the small arms range. In the past, a variety of weapons were used in training operations and EOD was conducted south of the small arms range. The area has been repeatedly policed by demolition personnel for remaining live rounds. Nevertheless, a possibility exists that unexploded ordnance remains in the area that could be uncovered by erosion.

## EVALUATION OF PAST DISPOSAL ACTIVITIES AND FACILITIES

The review of past operation and maintenance functions and past waste management practices at Buckley ANGB have resulted in the identification of eight sites containing hazardous waste materials that have the potential for migration of contamination. Other sites were reviewed and eliminated from further evaluation based on the logic presented in the decision tree shown in Figure 4.1.

The eight sites have been assessed using a hazard assessment rating methodology (HARM), which takes into account characteristics of potential receptors, waste characteristics, pathways for migration, and specific characteristics of the site related to waste management practices. The details of the rating procedures are presented in Appendix I and the results of the assessment are summarized in Table 4.2. The HARM system is designed to indicate the relative need for follow-on action. The information presented in Table 4.3 is intended as a guide for assigning priorities for further evaluation of the Buckley ANGB disposal areas (Chapter V, Conclusions and Chapter VI, Recommendations). The rating forms for the individual waste disposal sites on Buckley ANGB are presented in Appendix J. Photographs of some of the key disposal sites are contained in Appendix F.

# CHAPTER V

# CONCLUSIONS

# CHAPTER V

# CONCLUSIONS

The goal of the IRP Phase I study is to identify sites where there is the potential for environmental contamination resulting from past waste disposal practices and to assess the probability of contaminant migration from these sites. The conclusions given below are based on the assessment of the information collected from the project team's field inspection, review of records and files, review of the environmental setting, and interviews with base personnel, past employees and state and local government employees. Table 5.1 contains a list of the potential contamination sources identified at Buckley ANGB and a summary of HARM scores for those sites.

1. Fire Training Area No. 2 has a moderate potential for migration of contaminants. The site was used by the fire department from 1950 until 1972. Hazardous materials including avgas, JP-4, and possibly waste solvents were burned in the area. The site is unlined and within 2,000 feet of the nearest well. FTA No. 2 received a HARM score of 63.

2. The oil pit has a moderate potential for migration of contaminants. The pit contains standing oil and possibly waste solvents. The oil pit is within the East Toll Gate Creek flood plain. The depth to groundwater is estimated to be less than 20 feet. The pit received a HARM score of 62.

3. The base dump has a moderate potential for migration of contaminants. The dump received municipal refuse from Buckley ANGB and Lowry AFB. Paints, solvent containers, pesticide containers, and fuel tank sludges were also deposited in the dump. The site lies within the flood plain of East Toll Gate Creek and is within 500 feet of the installation boundary. The base dump received a HARM score of 61.

4. Fire Training Area No. 3 has a moderate potential for migration of contaminants. The site is used for training exercises by the fire department. Contaminated fuels and possibly waste solvents have been burned in the area. The pit is unlined and is within 1,000 feet of the installation boundary. FTA No. 3 received a HARM score of 61.

5. Fire Training Area No. 1 has a moderate potential for migration of contaminants. The site was used by the fire department during the late 1940's. Contaminated avgas and possibly waste solvents were burned in the area. The pit is unlined and within 500 feet of the nearest surface water. FTA No. 1 received a HARM score of 55.

6. The storm drainage system adjacent to Building 801 has a moderate potential for contaminant migration. Aircraft cleaning compounds, fuels, de-icers, and possibly solvents have been washed to the drainage system. Contaminants may migrate through sediments leaching into the local surface waters and infiltrating into the groundwater system. The storm drainage system received a HARM score of 52.

7. The sludge drying beds have a low potential for contaminant migration. The beds were in operation from 1942 until 1978. Potentially hazardous materials in the form of heavy metals could have accumulated in the sediments within the drying beds. The drying beds are within 100 feet of the installation boundary. The sludge drying beds received a HARM score of 46.

8. The Army aircraft burial site has a low potential for migration of contaminants. The site may contain small amounts of radioactive materials, including radium sulfide paint and electron source tubes. The site is within 1,500 feet of the installation boundary. The Army aircraft burial site received a HARM score of 40.

# CHAPTER VI

# RECOMMENDATIONS

# CHAPTER VI

## RECOMMENDATIONS

A total of eight sites have been identified as having received hazardous materials at Buckley ANGB. To aid in comparison of these eight sites, the hazardous assessment rating methodology (HARM) was applied. The HARM rating scores indicate the relative need for follow-up work in the Installation Restoration Program. Sites receiving HARM scores between 50 and 65 are considered to have a moderate potential for migration of contaminants, and follow-up Phase II investigations are recommended. Sites receiving HARM scores of less than 50 are considered to have low potential for contaminant migration, and no additional Phase II investigations are recommended. The following recommendations are made to further assess the potential for contaminant migration from hazardous-material receiving areas at Buckley ANGB. The recommended monitoring program is summarized in Table 6.1. Monitoring loctions are given in Figure 6.1.

1. Fire Training Area No. 2 is considered to have a moderate potential for migration of contaminants, and monitoring of the site is recommended. The recommended monitoring includes the collection of soil boring samples from three test holes located (1) at the site, (2) 100 feet north, and (3) 100 feet east. The test holes should be 25 feet deep, with samples collected at the surface and at five-foot intervals. If groundwater is encountered, it too should be collected. All samples should be analyzed for the parameters listed in Table 6.2. The bore holes should be used as groundwater monitoring well for continued operation.

2. The oil pit has a moderate potential for migration of contaminants and monitoring is recommended. The contents of the pit should be analyzed. Soil boring samples should be collected from 15-foot deep test holes located 50 feet up-gradient (east) and 50 feet down-gradient (west) of the pit. Soil samples should be collected at the ground surface and at five-foot intervals. All samples should be analyzed for the parameters listed in Table 6.2 as should any groundwater encountered. The bore holes should be used for groundwater monitoring.

3. The base dump has a moderate potential for contaminant migration. Soil boring samples should be collected from test holes located (1) upstream of the site and (2) downstream (at the west boundary of Buckley ANGB). The test holes should be 15 feet deep with samples collected at the ground surface and at five-foot intervals. Any groundwater encountered should also be collected. The bore holes should be used as groundwater monitoring wells for continued monitoring. The samples should be analyzed for the parameters listed in

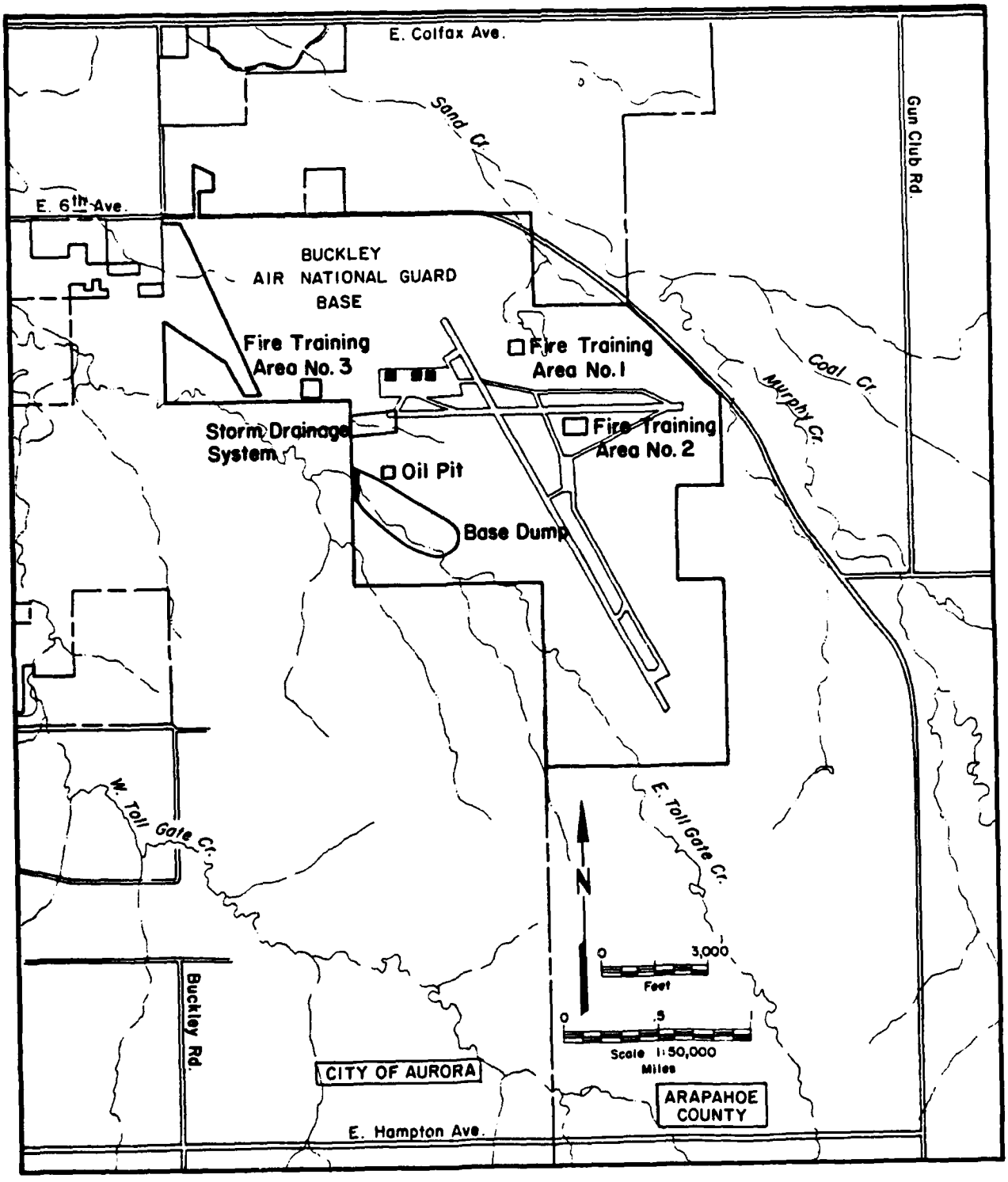



**FIGURE 6.1. RECOMMENDED MONITORING LOCATIONS**

Table 6.2. Samples should also be collected from East Toll Gate Creek during periods of storm runoff. The samples should be collected upstream and downstream of the site.

4. Fire Training Area No. 3 has a moderate potential for contaminant migration. The monitoring program should be similar to that proposed for FTA No. 2. The test holes should be located (1) within the area, (2) 100 feet south, and (3) 100 feet west of the area.

5. Fire Training Area No. 1 has a moderate potential for contaminant migration. The monitoring program should be similar to that proposed for FTA No. 2. Test holes should be located within the area and 200 feet northeast (towards the abandoned reservoir). The test holes should be 30 feet deep.

6. The storm drainage system adjacent to Building 801 has a moderate potential for migration of contaminants. Sediment samples should be collected from the drainage ditch at two locations. One sample should be collected adjacent to the apron area and the other collected at the west boundary of the installation. Samples should also be collected from storm water runoff at the installation boundary. Samples should be analyzed for the parameters listed in Table 6.2.

In addition to the recommendations made for Phase II of the IRP, the following recommendations are made.

1. The sludge drying bed at the sewage treatment plant was in use for 36 years and the plant received occasional slugs of industrial-type wastes. It is possible that heavy metals have collected in the soils underlying the bed. The sewage treatment plant is located on a small parcel of land outside the main base boundaries. It is recommended that a soil boring be made to a depth of 15 feet at the northwest corner of the bed. Samples should be collected at five-foot intervals and analyzed for heavy metals, total organic carbon, and oil and grease. If groundwater is encountered, it should be analyzed for the same parameters.

2. The area south of Building 1111 was used for small weapons training and some unexploded ordnance may exist. Signs indicating this possibility should be erected in the area.

# APPENDIX A

# BIOGRAPHICAL DATA

Ruh-Ming Li
Executive Vice President and Principal Hydraulic Engineer
Simons, Li & Associates, Inc.

## EDUCATION

| | | |
|---|---|---|
| Cheng Kung University, Taiwan: | B.S. in Hydraulic Engineering, | 1965 |
| Colorado State University: | M.S. in Civil Engineering, | 1972 |
| Colorado State University: | Ph.D. in Civil Engineering, | 1974 |

## TECHNICAL SOCIETIES

American Society of Civil Engineers, Member

American Geophysical Union, Member

## HONORS

Walter L. Huber Award for Outstanding Research in Civil Engineering, American Society of Civil Engineers, 1979

Who's Who in Engineering

Who's Who in Technology Today

Who's Who in the West

## NATIONAL COMMITTEES

Member, Committee on Erosion and Sedimentation, American Geophysical Union

Member, Task Group on Modeling of Environmental Fate of Chemical Substances, American Society for Testing and Materials

Principal Writer, State-of-the-Art Report on Physics-based Environmental Modeling of Material Release and Waste Disposal for American Society of Civil Engineers

## PUBLICATIONS

Over 250 papers and reports in the fields of hydrology, hydraulics, water resources development, and sediment transport.

## EXPERIENCE SUMMARY

Dr. Li has more than 15 years of experience in engineering consulting, design and construction supervision and is recognized as a leader in the fields of mathematical modeling of watersheds and river systems. As General

Kenneth G. Eggert
Director of Energy Related Projects
Simons, Li & Associates, Inc.

EDUCATION

| | | |
|---|---|---|
| Purdue University: | B.S. in Aeronautic & Astronautical Engineering, 1969 | |
| Colorado University: | M.S. in Civil Engineering, | 1976 |
| Colorado State University: | Ph.D. in Civil Engineering, | 1980 |

REGISTRATION

Registered Professional Engineer in: Colorado, No. 17054
Montana, pending

TECHNICAL SOCIETIES

American Society of Civil Engineers, Member

PUBLICATIONS

30 technical papers and reports in the fields of hydrology, hydraulics, and water resources.

EXPERIENCE SUMMARY

Dr. Eggert's interests have been in the development and application of mathematic simulation techniques to problems in hydrologic and hydraulic engineering. He was instrumental in the development of models used to predict surface water and sediment response from watersheds. Applications of these models include prediction of impacts resulting from land use alternatives, calculation of flows in ungaged watersheds, and migration of wastes and pollutants.

His current responsibilities as Director of Energy Related Projects include oversight of permitting studies. These include environmental baseline studies, permit and licensing applications and environmental studies related to the energy and mining industry. His qualifications for these tasks include a knowledge of the state and federal permit process for surface mining, hydropower, hazardous wastes, and of the NEPA process in general. He is also supervising preparation of a short course on the design of water diversions and sediment control in minelands.

Thomas P. Ballestero
Senior Hydrologist
Simons, Li & Associates, Inc.

EDUCATION

| | |
|---|---|
| Pennsylvania State University: | B.S. in Civil Engineering, 1975 |
| Pennsylvania State University: | M.S. in Civil Engineering, 1977 |
| Colorado State University: | Ph.D. in Civil Engineering, 1981 |

REGISTRATION

Professional Engineering registration in Colorado forthcoming.

TECHNICAL SOCIETIES

American Geophysical Union, Member

American Water Resources Association, Member

National Water Well Association, Member

PUBLICATIONS

Fourteen publications on the topics of design of nuclear power plant cooling systems, reservoir operating procedures, water resources planning, flood frequency analysis, hydrogeology, hydrology and statistics.

EXPERIENCE SUMMARY

Dr. Ballestero's work with SLA includes stochastic analysis of daily flows and generation of daily intermittent flows in the Rio Grande watershed, proposals for work and research, a reconnaissance study of low-head hydropower feasibility in the Pacific Northwest, analysis of the hydrology and the scour and deposition periods of the Cowlitz River, environmental assessments, expert witness service, development of statistical programs to analyze hydrologic data, interpretation of water quality analyses, economic analyses of alternatives, and groundwater resources development.

At Colorado State University, Dr. Ballestero majored in hydrology and water resources. He performed research on the modeling of underground pollutant transport and the determination of reservoir operating rules.

Thomas C. Fairley
Environmental Engineer
Simons, Li & Associates, Inc.

EDUCATION

University of Colorado: B.S. in Civil Engineering, 1980

REGISTRATION

Engineer-in-Training, Colorado

EXPERIENCE SUMMARY

Since joining Simons, Li & Associates, Inc. in 1981, Mr. Fairley has completed a variety of projects involving water and sediment runoff analysis, design of hydraulic structures, effects of urban and mined land runoff, and hydraulic and hydrologic modeling.

Prior to joining Simons, Li & Associates, Inc., Mr. Fairley worked for Camp Dresser & McKee, Inc. While with Camp Dresser & McKee, Inc., Mr. Fairley was involved in an industrial waste survey, sludge drying bed study, and design of improvements to the industrial waste collection, pumping, and treatment system at Stapleton International Airport in Denver, Colorado. Mr. Fairley also prepared a report discussing the effects of Stapleton's waste on Sand Creek and designed improvments to the industrial waste collection system at Frontier Airlines' facilities at Stapleton International Airport.

Other projects included preparation of federal flood insurance studies for nine Colorado communities, construction management for the City and County of Denver during construction of $6 million in improvements to the wastewater collection system, and supervision of a comprehensive monitoring program for the Omaha, Nebraska combined sewer system.

# APPENDIX B

## OUTSIDE AGENCY CONTACT LIST

1. United States Department of Commerce, National Weather Service, Denver, Colorado, (303)398-3964.

2. United States Department of the Interior, Geological Survey, Denver, Colorado; Mr. S. G. Robson, (303) 837-4169.

3. United States Department of Agriculture, Soil Conservation Service, Lakewood, Colorado; Mr. Roy Bell, (303) 837-5688.

4. United States Environmental Protection Agency, Region VIII, Denver, Colorado; Mr. Bob Burm, (303) 837-4901.

5. United States Fish and Wildlife Service, Western Regional Office, Salt Lake City, Utah; Mr. Fred Bolwahnn, (801) 524-4430.

6. Colorado Geological Survey, Denver, Colorado, (303) 866-2611.

7. Colorado State Engineer, Water Well Records, Denver, Colorado, (303) 866-3581.

8. Colorado Division of Water Resources, Denver, Colorado; Mr. John Romero, (303) 866-3587.

9. Colorado Water Conservation Board, Denver, Colorado, (303) 866-3441.

10. Colorado Division of Wildlife, Denver, Colorado, (303) 825-1192.

11. Colorado Department of Health, Denver, Colorado; Mr. Dennis Sanderson and Mr. Curtis Sutton, (303) 320-8333.

12. Urban Drainage and Flood Control District, Denver, Colorado; Mr. Ben Urbonas, (303) 455-6277.

13. Plains Conservation Center, Arapahoe County, Colorado.

14. City of Aurora, Wastewater Division, Mr. Bob Genty (303) 695-7519.

# APPENDIX C

# HISTORY OF BUCKLEY AIR NATIONAL GUARD BASE

APPENDIX C

HISTORY OF BUCKLEY ANGB

I. HISTORY

The increasing involvement of the United States in the European War in 1941 resulted in plans to enlarge Lowry Army Air Field. The site for Buckley ANG Base was purchased by the City and County of Denver and donated to the Department of the Army in early 1942. The site was named Buckley Field in honor of Lt. John Harold Buckley, a World War I flying hero from Colorado who died in action in 1918.

A contract for architectural and engineering services was awarded in April 1942, and construction began in May 1942. The Army Air Corps Technical School, Buckley Field, was opened July 1, 1942, with Brigadier General L. A. Lawson commanding. Physical facilities included streets, runways, over 700 structures, 10 water wells, a water distribution system, a sewage collection and treatment system, an electric distribution system, a communications system, 16,800 feet of railroad track and a coal-fired steam heating system.

Training was offered in B-17 and B-24 aircraft armaments. The increasing need for military personnel required additional basic training sites, and in 1943, three basic training camps were opened at the Lowry Bombing Range under Buckley command. The Arctic Training Command was transferred to Buckley Field in 1943 and a separate training facility was opened at Echo Lake, Colorado. The period from January through June of 1943 saw 30,000 personnel receive armament training, 10,000 personnel receive basic training, and 2,000 receive Arctic training. As the Army Air Corps approached full strength in 1944, additional training requirements diminished. Buckley Field saw a gradual decline in personnel in 1944 and 1945 and was designated as a sub-base of Lowry in 1946. Operation of Buckley was transferred to the Colorado Air National Guard in 1946 as a training site. In 1947, the Department of the Navy assumed command and renamed the facility Naval Air Station - Denver, Colorado. The Navy operated the facility as a training base and transient air station. The U.S. Navy deactivated the station at Buckley in May 1959, and ownership was licensed to the State of Colorado. The installation was then named Buckley Air National Guard Base, and the ANG has operated the base since then.

# APPENDIX D

# SUPPLEMENTAL ENVIRONMENTAL SETTING INFORMATION

# APPENDIX D

# SUPPLEMENTAL ENVIRONMENTAL SETTING INFORMATION

Buckley ANG Base is situated in the high plains of eastern Colorado. The fauna and flora of the area are typical of semiarid prairie regions. Buckley is bounded on the west and north by the City of Aurora, on the south by the Plains Conservation Center, and on the east by agricultural land. Studies were conducted in 1975 by the Soil Conservation Service and the Colorado Division of Wildlife as part of the Environmental Impact Statement for the Aurora Tollgate Village Development. These studies found no rare or endangered species of plants or animal life. The types of vegetation found at the Plains Conservation Center (located on the southern boundary of Buckley) are identified in Table D-1. Wildlife found in the area are identified in Table D-2. This table lists all species that have been sighted in the last 15 years.

Buckley ANGB is located in the historical range of the black-footed ferret, Mustela nigripes, but no sightings have been made at Buckley of this endangered species and no sightings have been made in the state of Colorado in the past 15 years. Golden and bald eagles occasionally migrate through the Buckley region, but do not nest in the area.

Table D.2a. Mammals Found in the Buckley ANG Base Region.

| | |
|---|---|
| Masked Shrew<br>*Sorex cinereus* | Silky Pocket Mouse<br>*Perognathus flavus* |
| Least Shrew<br>*Cryptotis parva* | Hispid Pocket Mouse<br>*Perognathus hispidus* |
| Eastern Cottontail<br>*Sylvilagus floridanus* | Ord's Kangaroo Rat<br>*Dipodomys ordii* |
| Desert Cottontail<br>*Sylvilagus audubonii* | Beaver<br>*Castor canadensis* |
| White-tailed Jackrabbit<br>*Lepus townsendii* | Plains Harvest Mouse<br>*Reithrodontomys montanus* |
| Black-tailed Jackrabbit<br>*Lepus californicus* | Western Harvest Mouse<br>*Reithrodontomys megalotis* |
| Least Chipmunk<br>*Eutamias minimus* | Deer Mouse<br>*Deromyscus maniculatus* |
| Thirteen-lined Ground Squirrel<br>*Spermophilus tridecemlineatus* | Northern Grasshopper Mouse<br>*Onochomys leucogaster* |
| Spotted Ground Squirrel<br>*Spermophilus spilosoma* | Meadow Vole<br>*Microtus pennsylvanicus* |
| Rock Squirrel<br>*Spermophilus variegatus* | Prairie Vole<br>*Microtus ochrogaster* |
| Black-tailed Prairie Dog<br>*Cynomys iudouicianus* | Muskrat<br>*Ondatra zibethicus* |
| Fox Squirrel<br>*Sciurus niger* | Meadow Jumping Mouse<br>*Zapus hudsonius* |
| Northern Pocket Gopher<br>*Thomomys talpoides* | Porcupine<br>*Erethizon dorsatum* |
| Plains Pocket Gopher<br>*Geomys bursarius* | Coyote<br>*Canis latrans* |
| Olive-backed Pocket Mouse<br>*Perognathus fasciatus* | Red Fox<br>*Vulpes vulpes* |
| Plains Pocket Mouse<br>*Perognathus flauescens* | Swift Fox<br>*Vulpes velox* |

Table D.2b. Marsupials Found in the Buckley ANG Base Region.

| |
|---|
| Opposum<br>*Didelphis marsupialis* |

Table D.2d. Birds Found in the Buckley ANG Base Region (including residents, migrants and stragglers).

---

Common Loon
Arctic Loon
Red-necked Grebe
Horned Grebe
Eared Grebe
Western Grebe
Pie-billed Grebe
White Pelican
Double-crested Cormorant
Great Blue Heron
Northern Green Heron
Little Blue Heron
Cattle Egret
Great Egret
Snowy Egret
Louisiana Heron
Black-crowned Night Heron
Yellow-crowned Night Heron
American Bittern
White-faced Ibis
Whistling Swan
Canada Goose
Brant
White-fronted Goose
Snow Goose
Ross' Goose
Mallard
Black Duck
Gadwall
Pintail
American Green-winged Teal
Blue-winged Teal
Cinnamon Teal
European Wigeon
Northern Shoveler
Wood Duck
Redhead
Ring-necked Duck
Canvasback
Greater Scaup
Lesser Scaup
Common Goldeneye
Barrow's Goldeneye
Bufflehead
Oldsquaw
Harlequin Duck
White-winged Scoter
Surf Scoter
Black Scoter
Ruddy Duck
Hooded Merganser
Common Merganser
Red-Breasted Merganser
Turkey Vulture
Goshawk
Sharp-shinned Hawk
Cooper's Hawk
Red-tailed Hawk
Red-shouldered Hawk
Broad-winged Hawk
Swainson's Hawk
Rough-legged Hawk
Ferruginous Hawk
Golden Eagle
Bald Eagle
Marsh Hawk
Osprey
Gyr Falcon
Prairie Falcon
Peregrine Falcon
Merlin
American Kestrel
Sharp-tailed Grouse
Bobwhite
Ring-necked Pheasant
Chukar
Turkey
Sandhill Crane
Virginia Rail
Sora
American Coot
Semipalmated Plover
Piping Plover
Snowy Plover
Killdeer
Mountain Plover
American Golden Plover
Black-bellied Plover
Ruddy Turnstone
Common Snipe
Long-billed Curlew
Whimbrel

Table D.2d continued.

| | |
|---|---|
| Black-billed Magpie | Red-eyed Vireo |
| Common Raven | Philadelphia Vireo |
| White-necked Raven | Warbling Vireo |
| Common Crow | Black-and-white Warbler |
| Pinyon Jay | Worm-eating Warbler |
| Clark's Nutcracker | Golden-winged Warbler |
| Black-capped Chickadee | Blue-winged Warbler |
| Mountain Chickadee | Tennessee Warbler |
| White-breasted Nuthatch | Orange-crowned Warbler |
| Red-breasted Nuthatch | Nashville Warbler |
| Pygmy Nuthatch | Virginia's Warbler |
| Brown Creeper | Northern Parula |
| Dipper | Yellow Warbler |
| House Wren | Magnolia Warbler |
| Winter Wren | Black-throated Blue Warbler |
| Bewick's Wren | Yellow-rumped Warbler |
| Carolina Wren | Black-throated Gray Warbler |
| Long-billed Marsh Wren | Townsend's Warbler |
| Canyon Wren | Black-throated Green Warbler |
| Rock Wren | |
| Mockingbird | Blackburnian Warbler |
| Gray Catbird | Yellow-throated Warbler |
| Trown Thrasher | Chestnut-sided Warbler |
| Sage Thrasher | Bay-breasted Warbler |
| American Robin | Blackpoll Warbler |
| Varied Thrush | Palm Warbler |
| Wood Thrush | Ovenbird |
| Hermit Thrush | Northern Waterthrush |
| Swainson's Thrush | MacGillivray's Warbler |
| Gray-cheeked Thrush | Common Yellowthroat |
| Veery | Yellow-breasted Chat |
| Eastern Bluebird | Hooded Warbler |
| Western Bluebird | Wilson's Warbler |
| Mountain Bluebird | Canada Warbler |
| Townsend's Solitaire | American Redstart |
| Blue-gray Gnatcather | House Sparrow |
| Golden-crowned Kinglet | Bobolink |
| Ruby-crowned Kinglet | Western Meadowlark |
| Water Pipit | Yellow-headed Blackbird |
| Sprague's Pipit | Red-winged Blackbird |
| Bohemian Waxwing | Orchard Oriole |
| Cedar Waxwing | Northern Oriole |
| Northern Shrike | Rusty Blackbird |
| Loggerhead Shrike | Brewer's Blackbird |
| Starling | Common Grackle |
| Bell's Vireo | Brown-headed Cowbird |
| Yellow-throated Vireo | Western Tanager |
| Solitary Vireo | Scarlet Tanager |

# APPENDIX E

## SHOP LISTING

Master List of Shops

| Name | Building Number | Waste Generator |
|---|---|---|
| Aerospace Ground Equipment | 814 | * |
| Aircraft Maintenance Docks | 801 | * |
| Avionics | 950 | |
| Corrosion Control/Fuel Cell Repair | 800 | * |
| Electrical/Environmental Shop | 801 | * |
| Flight Simulator | 850 | |
| Jet Engine Shop | 960 | |
| Machine Shop | 801 | |
| Munitions Storage | 924 | |
| NDI/SOAP Laboratory | 801 | * |
| Parachute/Life Support Shop | 801 | |
| Pneudraulic/Hydraulic Shop | 801 | |
| Reclamation/Tire Shop | 801 | * |
| Structural Repair | 801 | |
| Weapons Shop | 950 | |
| Welding Shop | 801 | |
| War Readiness Supply Kit | 504 | |
| Motor Pool | 940 | * |
| Refueling Maintenance | 710 | |
| Base Hospital | 33 | |
| 154th Tactical Control Group | 25 | |
| Base Photo Laboratory | 801 | * |
| Transient Maintenance | 909 | |
| Base Supply | 841 | |
| POL/Fuels Laboratory | 300 | * |
| Shipping/Transportation | 841 | |
| Civil Engineering Carpenter Shop | 711 | |
| Civil Engineering Electric Shop | 711 | |
| Civil Engineering Equipment Shop | 711 | |
| Civil Engineering Heating Plant | 903 | |

# APPENDIX F

# PHOTOGRAPHS


FIGURE F.3. FIRE TRAINING AREA NO. 3

FIGURE F.4. FIRE TRAINING AREA NO. 3

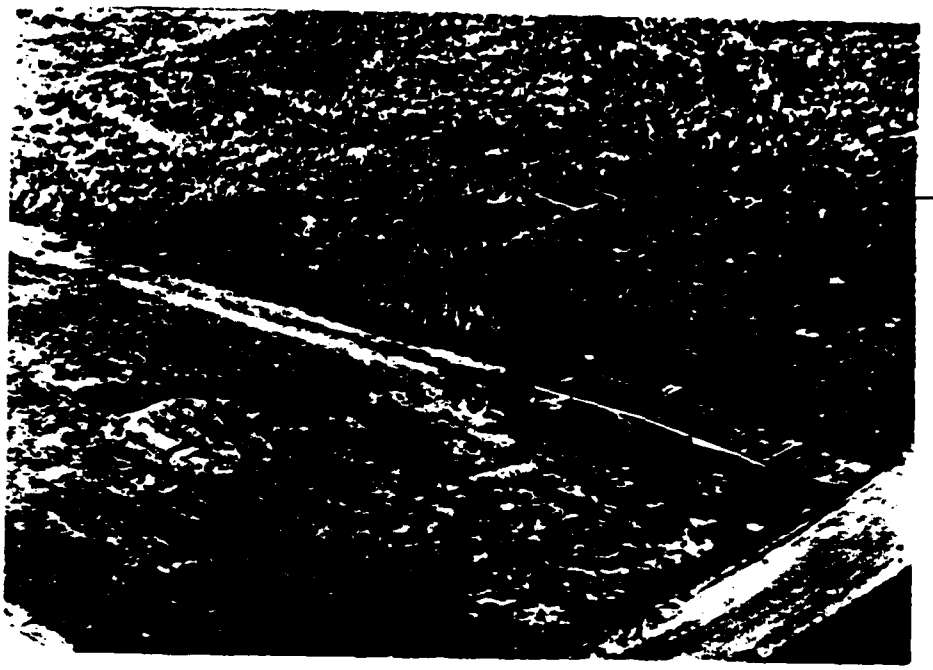



FIGURE F.7. OIL PIT

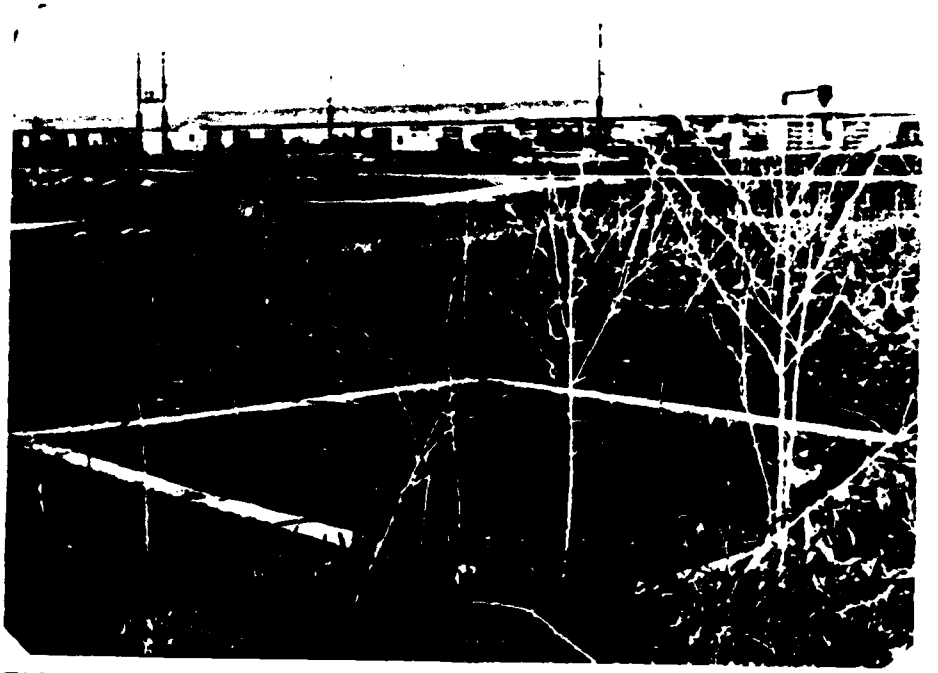


FIGURE F.8. OIL PIT

# APPENDIX G

## STORAGE AND DISPOSAL OF DDT AND RESULTS OF PCB ANALYSIS

# APPENDIX G

## STORAGE AND DISPOSAL OF DDT

Several thousand pounds of DDT were stored at Buckley ANGB for a short period of time. The disposal of the DDT was handled by a private contractor (Chemical Waste Management)through DPDO. Following disposal, the storage area was cleared of any residual material by the contractor. The attached correspondance documents the Air National Guard involvement.

Also included in this appendix are the laboratory analyses of electric transformers.

# DEPARTMENT OF MILITARY AFFAIRS

OPERATING LOCATION AA (COANG)
BUCKLEY AIR NATIONAL GUARD BASE, AURORA, COLORADO 80011

REPLY TO
ATTN OF OL-AA/CC

18 November 1981

SUBJECT Storage of DDT

TO EPA Air and Hazardous Materials Division (Mr Lawrence Wapenski)
1860 Lincoln St
Denver, Colorado 80295

As a follow up to our letter to you on 29 October 1981 concerning DDT Storage at Buckley ANG Base on 17 November 1981 all DDT stored at this installation was removed. This material was picked up by Chemical Waste Management Corporation under a contract issued by the Defense Logistics Agency. The storage area was properly cleaned and all contaminated materials removed by the contractor. All removed material is to be properly disposed of in accordance with Federal Regulation. We are told by DLA it will be several weeks before we have a manifest.

Thank you for your cooperation and assistance in this matter and hopefully we can consider it closed.

STANLEY C. WOOD, Col, COANG
Base Commander

# DEPARTMENT OF MILITARY AFFAIRS

OPERATING LOCATION AA (COANG)
BUCKLEY AIR NATIONAL GUARD BASE, AURORA, COLORADO 80011

140 TAC HOSPITAL/SGP 2 July 81

Analysis of Transformer Oil Samples

USAF OEHL/SA
Brooks AFB, TX 78235

Request that your laboratory analyze the enclosed transformer oil samples in the most expedient manner possible. These samples were taken from transformers being shipped off-base to a factory in South Dakota for rebuilding. The company refuses to accept PCB contaminated equipment. The electrical contractor working at Buckley ANG Base has a contractual obligation to dispose of the transformers in a proper manner and this is based on PCB concentration. The attached listing includes the serial numbers of the transformers and this number is used to identify the sample. Thank you for your attention to this request.

Michael P. Rowan

MICHAEL P. ROWAN, GS-7
Environmental Health Technician

## LIST OF USED TRANSFORMERS

| POLE MOUNT TRANSFORMERS | | MAKE | SERIAL NUMBER |
|---|---|---|---|
| 1. | 50 KVA | GE 120/240 | K497534K72AA |
| 2. | 50 KVA | GE 12/240 | K497536K72AA |
| 3. | 25 KVA | Harrison Trans Co 120/240 | 67084 |
| 4. | 37½ KVA | McGraw Edison 120/240 | 70VF614006 |
| 5. | 37½ KVA | McGraw Edison 120/240 | 70VF614007 |
| 6. | 37½ KVA | McGraw Edison 120/240 | 70VF614005 |
| 7. | 15 KVA | Line Matfrial 12-.240 | 286183 |
| 8. | 5 KVA | GE 120/240 | D468230-60P |
| 9. | 25 KVA | Line Material 120/240 | 285983 |
| 10. | 50 KVA | Kulhman 277 | 4630861002 |
| 11. | 50 KVA | Kulhman 277 | 4630861001 |
| 12. | 50 KVA | Kulhman 277 | 4630861003 |
| 13. | 25 KVA | Line Material 120/240 | 284647 |
| 14. | 15 KVA | Line Material 120/240 | F2350604 |
| 15. | 37½ KVA | GE 120/240 | E10834-60Y |
| 16. | 37½ KVA | GE 277/480Y | M538794YFPA |
| 17. | 37½ KVA | GE 277/480Y | M538799YFPA |
| 18. | 37½ KVA | GE 277/480Y | M538797YFPA |
| 19. | 37½ KVA | GE 277/480Y | M538798YFPA |
| 20. | 37½ KVA | GE 277/480Y | M538796YFPA |
| 21. | 37½ KVA | GE 270/480Y | M585968YFPA |
| 22. | 15 KVA | ESCO 120/240 | 7128227 |
| 23. | 25 KVA | RTE 120/240 | 7220319 |
| 24. | 25 KVA | RTE 120/240 | 7220318 |
| 25. | 25 KVA | Line Material 120/240 | 284638 |
| 26. | 50 KVA | Allis Chalmers 120/240 | 1809977 |
| 27. | 50 KVA | Allis Chalmers 120/240 | 1809991 |
| 28. | 50 KVA | Line Material 120/240 | 288515 |
| 29. | 25 KVA | Line Material 120/240 | 284657 |
| 30. | 37½ KVA | Line Material 120/240 | G41J4209 |
| 31. | 37½ KVA | Line Materials 120/240 | G26K9906 |
| 32. | 37½ KVA | Line Materials 120/240 | G3726802 |
| 33. | 75 KVA | Line Materials 120/240 | 285794 |
| 34. | 75 KVA | Line Materials 120/240 | 287601 |
| 35. | 75 KVA | Line Materials 120/240 | 287599 |
| 36. | 50 KVA | Allis Chalmers 120/240 | 5369662 |
| 37. | 50 KVA | Trans. Unlimited 120/240 | 73J2265 |
| 38. | 50 KVA | Allis Chalmers 120/240 | 5369667 |
| 39. | 100 KVA | Trans Unlimited 240/480 | B469394 |
| 40. | 100 KVA | Trans Unlimited 240/480 | B469392 |
| 41. | 100 KVA | Trans Unlimited 240/480 | B469393 |
| 42. | 75 KVA | Moloney 120/240 | 1751963-1 |
| 43 | 75 KVA | Moloney 120/240 | 1751963-2 |
| 44. | 75 KVA | Moloney 120/240 | 1751963-3 |
| 45. | 200 KVA | Allis Chalmers 120/240 | 1816045 |
| 46. | 200 KVA | Allis Chalmers 120/240 | 1816046 |

LIST OF USED TRANSFORMERS (Con't)

| POLE MOUNT TRANSFORMERS | | MAKE | SERIAL NUMBER |
|---|---|---|---|
| 47. | 200 KVA | Allis Chalmers 120/240 | 1816043 |
| 48. | 37.5 KVA | Line Material 120/240 | 284225 |
| 49. | 37.5 KVA | Line Material 120/240 | 285881 |
| 50. | 37.5 KVA | Allis Chalmers 120/240 | 1812302 |
| 51. | 15 KVA | Line Material 12-.240 | 286204 |
| 52. | 50 KVA | Allis Chalmers 120/240 | 5369665 |
| 53. | 15 KVA | Line Material 120/240 | 286215 |
| 54. | 15 KVA | Line Material 120/240 | 286105 |
| 55. | 15 KVA | Line Material 120/240 | 286074 |
| 56. | 37.5 KVA | Line Material 120/240 | 285860 |
| 57. | 15 KVA | Line Material 120/240 | 282370 |
| 58. | 50 KVA | GE 120/240 | K497535K72 |
| 59. | 37.5 KVA | Megraw Edison 120/240 | 69B6751004 |
| 60. | 37.5 KVA | Megraw Edison 120/240 | H1298101 |
| 61. | 15 KVA | Line Material 120/240 | 298980 |
| 62. | 15 KVA | Line Material 120/240 | 286202 |
| 63. | 25 KVA | GE 120/240 | FS60070-66P |
| 64. | 15 KVA | Line Material 120/240 | 286133 |
| 65. | 15 KVA | Line Material 120/240 | 286121 |
| 66. | 75 KVA | Line Material 120/240 | 285792 |
| 67. | 50 KVA | Line Material 120/240 | 288508 |
| 68. | 50 KVA | Allis Chalmers 120/240 | 1809975 |
| 69. | 50 KVA | Allis Chalmers 120/240 | 5369663 |
| 70. | 50 KVA | Allis Chalmers 120/240 | 5369659 |
| 71. | 25 KVA | Allis Chalmers 240/480 | 3500931 |
| 72. | 37.5 KVA | Allis Chalmers 240/480 | 1812286 |
| 73. | 10 KVA | Line Material 120/240 | 286300 |
| 74. | 25 KVA | Line Material 120/240 | 288102 |
| 75. | 9 KVA | GE 240 | B978542 |
| 76. | 37.5 KVA | Line Material 120/240 | 918945 |
| 77. | 37.5 KVA | Line Material 120/240 | 918890 |
| 78. | 37.5 KVA | Allis Chalmers 120/240 | 1812289 |
| 79. | 10 KVA | GE 120/240 | G296130-65Y |
| 80. | 37.5 KVA | Line Material 120/240 | ? |
| 81. | 75 KVA | Moloney 120/240 | 1752276-2 |
| 82. | 75 KVA | Moloney 120/240 | 1752276-3 |
| 83. | 75 KVA | Moloney 120/240 | 1752276-1 |
| 84. | 25 KVA | Harrison 120/240 | 67104 |
| 85. | 37.5 KVA | Allis Chalmers 120/240 | 1812279 |
| 86. | 45 KVA | Kuhlman 208/120 | 3-4744 |
| 87. | 37.5 KVA | Megraw Edison 120/240 | H1298103 |
| 88. | 5 KVA | Kuhlman 120/240 | A24133 |
| 89. | 150 KVA | Padmount Westinghouse 480/277 | 77D458183 |
| 90. | 150 KVA | Padmount Vantran 480/277 | 77V4964 |
| 91. | 75 KVA | Padmount GE 480/277 | S-NM320394TIPA |
| 92. | 500 KVA | Padmount GE 208/120 | NL707216TELA |
| 93. | 75 KVA | Padmount RTE 208/120 | 756002710 |

# APPENDIX H

# REFERENCES

## References


1. "Air Installation Compatible Use Zone," Buckley ANGB, Feb. 1976.

2. Histories of Buckley Field, Lowry AFB, and the 140th Fighter-Bomber Wing, obtained from Maxwell AFB, Alabama.

3. U.S. Dept. of Commerce, National Weather Service, "Local Climatological Data - Denver, Colorado," 1980.

4. U.S. H.U.D., Environmental Impact Statement, "Tollgate Village Planned Development," 1977.

5. Colorado Division of Wildlife, Mammal Distribution, 1978.

6. _____, Reptile and Amphibian Distribution, 1981.

7. _____, Bird Distribution, 1978.

8. U.S. Department of Agriculture, Soil Conservation Service, Soil Survey - Arapahoe County Colorado, 1971.

9. U.S. Geological Survey, "Generalized Surficial Geology Map of the Denver Area," 1972.

10. _____ "Geologic Structure, Hydrology and Water Quality of the Denver Aquifer," 1981.

11. _____ "Geological Structure, Hydrology and Water Quality of the Arapahoe Aquifer," 1981.

12. Colorado Water Conservation Board, "Basic Data Report No. 15, Groundwater in the Denver Region, 1965.

13. U.S. Geological Survey, "Fitzsimons" and "Coal Creek" Quadrangle maps.

14. The Merck Index, An Encyclopedia of Chemicals and Drugs, Merck and Company, Inc., Rahway, NJ, 1976.

15. Documentation of the Threshold Limit Values, Fourth Edition, American Conference of Governmental Industrial Hygienists, Cincinnati, 1980.

16. "Clinical Toxicology of Commercial Products," Gosselin, R. E. et al, Fourth Edition, Williams and Wilkins, Company, Baltimore, 1976.

17. Dangerous Properties of Industrial Materials, Sax, N. Irving, Fifth Edition, Van Nostrand Reihold Company, New York, 1979.

18. "1979 Registry of Toxic Effects of Chemical Substances," Volumes I and II, USDHHS, PHS, CDC NIOSH, Cincinnati, September 1980.

# APPENDIX I

# HAZARD ASSESSMENT RATING METHODOLOGY

# APPENDIX I

# USAF INSTALLATION RESTORATION PROGRAM

# HAZARD ASSESSMENT RATING METHODOLGY

## BACKGROUND

The Department of Defense (DOD) has established a comprehensive program to identify, evaluate, and control problems associated with past disposal practicies at DOD facilities. One of the actions required under this program is to:

> "develop and maintain a priority listing of contaminated installations and facilities for remedial action based on potential hazard to public health, welfare, and environmental impacts." (Reference: DEQPPM 81-5, 11 December 1981).

Accordingly, the United States Air Force (USAF) has sought to establish a system to set priorities for taking further action at sites based upon information gathered during the records search phase of its Installation Restoration Program (IRP).

The first site rating model was developed in June 1981 at a meeting with representatives from USAF Occupational Environmental Health Laboratory (OEHL), Air Force Engineering Services Center (AFESC), Engineering-Science (ES) and $CH_2M$ Hill. The basis for this model was a system developed for EPA by JRB Associates of McLean, Virginia. The JRB model was modified to meet Air Force needs.

After using this model for six months at over 20 Air Force installations, certain inadequacies became apparent. Therefore, on January 26 and 27, 1982, representatives of USAF OEHL, AFESC, various major commands, ES, and $CH_2M$ Hill met to address the inadequacies. The result of the meeting was a new site rating model designed to present a better picture of the hazards posed by sites at Air Force installations. The new rating model described in this presentation is referred to as the Hazard Assessment Rating Methodology.

## PURPOSE

The purpose of the site rating model is to provide a relative ranking of sites of suspected contamination from hazardous substances. This model will assist the Air Force in setting priorities for follow-on site investigations and confirmation work under Phase II of IRP.

## HAZARDOUS ASSESSMENT RATING FORM



E OF SITE _____

ATION _____

E OF OPERATION OR OCCURRENCE _____

ER/OPERATOR _____

MENTS/DESCRIPTION _____

E RATED BY _____

### RECEPTORS

| Rating Factor | Factor Rating (0-3) | Multiplier | Factor Score | Maximum Possible Score |
|---|---|---|---|---|
| Population within 1,000 feet of site | | 4 | | |
| Distance to nearest well | | 10 | | |
| Land use/zoning within 1 mile radius | | 3 | | |
| Distance to reservation boundary | | 6 | | |
| . Critical environments within 1 mile radius of site | | 10 | | |
| . Water quality of nearest surface water body | | 6 | | |
| . Ground water use of uppermost aquifer | | 9 | | |
| . Population served by surface water supply within 3 miles downstream of site | | 6 | | |
| . Population served by ground-water supply within 3 miles of site | | 6 | | |
| | | Subtotals | _____ | _____ |

Receptors subscore (100 X factor score subtotal/maximum score subtotal) _____

### II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) _____
2. Confidence level (C = confirmed, S = suspected) _____
3. Hazard rating (H = high, M = medium, L = low) _____

Factor Subscore A (from 20 to 100 based on factor score matrix) _____

B. Apply persistence factor
Factor Subscore A X Persistence factor = Subscore B

_____ X _____ = _____

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

_____ X _____ = _____

Figure I.2. Hazardous assessment rating form

Table I.1. Hazardous Assessment Rating Methodology Guidelines.

I. RECEPTORS CATEGORY

| Rating Factors | Rating Scale Levels 0 | 1 | 2 | 3 | Multiplier |
|---|---|---|---|---|---|
| A. Population within 1,000 feet (includes on-base facilities) | 0 | 1 - 25 | 26 - 100 | Greater than 100 | 4 |
| B. Distance to nearest water well | Greater than 3 miles | 1 to 3 miles | 3,001 feet to 1 mile | 0 to 3,000 feet | 10 |
| C. Land Use/Zoning (within 1 mile radius) | Completely remote (zoning not applicable) | Agricultural | Commercial or industrial | Residential | 6 |
| D. Distance to installation boundary | Greater than 2 miles | 1 to 2 miles | 1,001 feet to 1 mile | 0 to 1,000 feet | 3 |
| E. Critical environments (within 1 mile radius) | Not a critical environment | Natural areas | Pristine natural areas; minor wetlands; preserved areas; presence of economically important natural resources susceptible to contamination. | Major habitat of an endangered or threatened species; presence of recharge area; major wetlands. | 10 |
| F. Water quality/use designation of nearest surface water body | Agricultural or industrial use. | Recreation, propagation and management of fish and wildlife. | Shellfish propagation and harvesting. | Potable water supplies | 6 |
| G. Ground-Water use of uppermost aquifer | Not used, other sources readily available. | Commercial, industrial, or irrigation, very limited other water sources. | Drinking water, municipal water available. | Drinking water, no municipal water available; commercial, industrial, or irrigation, no other water source available. | 9 |
| H. Population served by surface water supplies within 3 miles downstream of site | 0 | 1 - 50 | 51 - 1,000 | Greater than 1,000 | 6 |
| I. Population served by aquifer supplies within 3 miles of site | 0 | 1 - 50 | 51 - 1,000 | Greater than 1, 000 | 6 |

Table I.1. (continued).

II. WASTE CHARACTERISTICS (Continued)

Waste Characteristics Matrix

| Point Rating | Hazardous Waste Quantity | Confidence Level of Information | Hazard Rating |
|---|---|---|---|
| 100 | L | C | H |
| 80 | L | C | M |
| | M | C | H |
| 70 | L | S | H |
| 60 | S | C | H |
| | M | C | M |
| 50 | L | S | M |
| | L | C | L |
| | M | S | H |
| | S | C | M |
| 40 | S | S | H |
| | M | S | M |
| | M | C | L |
| | L | S | L |
| 30 | S | C | L |
| | M | S | L |
| | S | S | M |
| 20 | S | S | L |

Notes:
For a site with more than one hazardous waste, the waste quantities may be added using the following rules:
Confidence Level
- o Confirmed confidence levels (C) can be added
- o Suspected confidence levels (S) can be added
- o Confirmed confidence levels cannot be added with suspected confidence levels

Waste Hazard Rating
- o Wastes with the same hazard rating can be added
- o Wastes with different hazard ratings can only be added in a downgrade mode, e.g., MCM + SCH = LCM if the total quantity is greater than 20 tons.

Example: Several wastes may be present at a site, each having an MCM designation (60 points). By adding the quantities of each waste, the designation may change to LCM (80 points). In this case, the correct point rating for the waste is 80.

B. Persistence Multiplier for Point Rating

| Persistence Criteria | Multiply Point Rating From Part A by the Following |
|---|---|
| Metals, polycyclic compounds, and halogenated hydrocarbons | 1.0 |
| Substituted and other ring compounds | 0.9 |
| Straight chain hydrocarbons | 0.8 |
| Easily biodegradable compounds | 0.4 |

C. Physical State Multiplier

| Physical State | Multiply Point Total From Parts A and B by the Following |
|---|---|
| Liquid | 1.0 |
| Sludge | 0.75 |
| Solid | 0.50 |

Table I.1. (continued).

IV. WASTE MANAGEMENT PRACTICES CATEGORY

A. This category adjusts the total risk as determined from the receptors, pathways, and waste characteristics categories for waste management practices and engineering controls designed to reduce this risk. The total risk is determined by first averaging the receptors, pathways, and waste characteristics subscores.

B. WASTE MANAGEMENT PRACTICES FACTOR

The following multipliers are then applied to the total risk points (from A):

| Waste Management Practice | Multiplier |
|---|---|
| No containment | 1.0 |
| Limited containment | 0.95 |
| Fully contained and in full compliance | 0.10 |

Guidelines for fully contained:

Landfills:

- o Clay cap or other impermeable cover
- o Leachate collection system
- o Liners in good condition
- o Adequate monitoring wells

Surface Impoundments:

- o Liners in good condition
- o Sound dikes and adequate freeboard
- o Adequate monitoring wells

Spills:

- o Quick spill cleanup action taken
- o Contaminated soil removed
- o Soil and/or water samples confirm total cleanup of the spill

Fire Proection Training Areas:

- o Concrete surface and berm.
- o Oil/water separator for pretreatment of runoff
- o Effluent from oil/water separator to treatment plant

General Note: If data are not available or known to be complete the factor ratings under items I-A through I, III-B-1 or III-B-3, then leave blank for calculation of factor score and maximum possible score.

Table I.2. (continued).

| | Recommended Rating Factors | | |
|---|---|---|---|
| | Toxicity | Ignitability | Radioactivity |
| Sludges from Sewage Treatment Plants | | | |
| Cadmium (and salts) | 3 | 0 | 0 |
| Chromium (and salts) | 3 | 0 | 0 |
| Nickel (and salts) | 3 | 0 | 0 |
| Mercury (and salts) | 3 | 0 | 0 |
| Lead (and salts) | 3 | 0 | 0 |
| Phenol | 3 | 0 | 0 |
| Pesticides | | | |
| Herbicides | | | |
| 2,4-D | 1 | 0 | 0 |
| 2,4,5-T | 1 | 0 | 0 |
| Silvex | 1 | 0 | 0 |
| Insecticides | | | |
| Aldrin | 3 | 0 | 0 |
| Parathion | 3 | 0 | 0 |
| Malathion | 1 | 0 | 0 |
| Sevin | 1 | 1 | 0 |
| Diazinon | 1 | 0 | 0 |
| Arsenic compounds | 3 | 0 | 0 |
| DDT | 1 | 0 | 0 |
| Endrin | 3 | 0 | 0 |
| Dieldrin | 3 | 0 | 0 |

# APPENDIX J

# WASTE SITE RATINGS

# HAZARDOUS ASSESSMENT RATING FORM



NAME OF SITE Fire Training Area No. 2

LOCATION Buckley ANGB, near Control Tower

DATE OF OPERATION OR OCCURRENCE 1950(?) - 1972

OWNER/OPERATOR Buckley Fire Department

COMMENTS/DESCRIPTION Fuels burning area

SITE RATED BY TCF

## I. RECEPTORS

| Rating Factor | Factor Rating (0-3) | Multiplier | Factor Score | Maximum Possible Score |
|---|---|---|---|---|
| A. Population within 1,000 feet of site | 1 | 4 | 4 | 12 |
| B. Distance to nearest well | 3 | 10 | 30 | 30 |
| C. Land use/zoning within 1 mile radius | 1 | 3 | 3 | 9 |
| D. Distance to reservation boundary | 2 | 6 | 12 | 18 |
| E. Critical environments within 1 mile radius of site | 2 | 10 | 20 | 30 |
| F. Water quality of nearest surface water body | 1 | 6 | 6 | 18 |
| G. Ground water use of uppermost aquifer | 2 | 9 | 18 | 27 |
| H. Population served by surface water supply within 3 miles downstream of site | 0 | 6 | 0 | 18 |
| I. Population served by ground-water supply within 3 miles of site | 1 | 6 | 6 | 18 |
| | | Subtotals | 99 | 180 |

Receptors subscore (100 X factor score subtotal/maximum score subtotal) 55

## II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) L
2. Confidence level (C = confirmed, S = suspected) K
3. Hazard rating (H = high, M = medium, L = low) H

Factor Subscore A (from 20 to 100 based on factor score matrix) 100

B. Apply persistence factor
Factor Subscore A X Persistence Factor = Subscore B

100 x 0.8 = 80

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

80 x 1.0 = 80

# HAZARDOUS ASSESSMENT RATING FORM



NAME OF SITE: Oil Pit

LOCATION: Buckley ANGB, near Building 711

DATE OF OPERATION OR OCCURRENCE: 1950(?) - 1982

OWNER/OPERATOR: Buckley ANGB

COMMENTS/DESCRIPTION:

SITE RATED BY: TCF

## I. RECEPTORS

| Rating Factor | Factor Rating (0-3) | Multiplier | Factor Score | Maximum Possible Score |
|---|---|---|---|---|
| A. Population within 1,000 feet of site | 2 | 4 | 8 | 12 |
| B. Distance to nearest well | 1 | 10 | 10 | 30 |
| C. Land use/zoning within 1 mile radius | 2 | 3 | 6 | 9 |
| D. Distance to reservation boundary | 3 | 6 | 18 | 18 |
| E. Critical environments within 1 mile radius of site | 1 | 10 | 10 | 30 |
| F. Water quality of nearest surface water body | 1 | 6 | 6 | 18 |
| G. Ground water use of uppermost aquifer | 2 | 9 | 18 | 27 |
| H. Population served by surface water supply within 3 miles downstream of site | 0 | 6 | 0 | 18 |
| I. Population served by ground-water supply within 3 miles of site | 1 | 6 | 6 | 18 |
| | | Subtotals | 82 | 180 |

Receptors subscore (100 X factor score subtotal/maximum score subtotal): 46

## II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large): M
2. Confidence level (C = confirmed, S = suspected): C
3. Hazard rating (H = high, M = medium, L = low): H

Factor Subscore A (from 20 to 100 based on factor score matrix): 80

B. Apply persistence factor
Factor Subscore A X Persistence Factor = Subscore B

80 X 0.8 = 64

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

64 X 1.0 = 64

# HAZARDOUS ASSESSMENT RATING FORM



NAME OF SITE Base Dump

LOCATION Buckley ANGB, along East Toll Gate Creek

DATE OF OPERATION OR OCCURRENCE 1942 - 1982

OWNER/OPERATOR Buckley ANGB

COMMENTS/DESCRIPTION

SITE RATED BY TCF

## I. RECEPTORS

| Rating Factor | Factor Rating (0-3) | Multiplier | Factor Score | Maximum Possible Score |
|---|---|---|---|---|
| A. Population within 1,000 feet of site | 2 | 4 | 8 | 12 |
| B. Distance to nearest well | 1 | 10 | 10 | 30 |
| C. Land use/zoning within 1 mile radius | 2 | 3 | 6 | 9 |
| D. Distance to reservation boundary | 3 | 6 | 18 | 18 |
| E. Critical environments within 1 mile radius of site | 1 | 10 | 10 | 30 |
| F. Water quality of nearest surface water body | 1 | 6 | 6 | 18 |
| G. Ground water use of uppermost aquifer | 2 | 9 | 18 | 27 |
| H. Population served by surface water supply within 3 miles downstream of site | 0 | 6 | 0 | 18 |
| I. Population served by ground-water supply within 3 miles of site | 1 | 6 | 6 | 18 |
| | | Subtotals | 82 | 180 |

Receptors subscore (100 X factor score subtotal/maximum score subtotal) 46

## II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) M
2. Confidence level (C = confirmed, S = suspected) K
3. Hazard rating (H = high, M = medium, L = low) H

Factor Subscore A (from 20 to 100 based on factor score matrix) 80

B. Apply persistence factor
Factor Subscore A X Persistence Factor = Subscore B

80 X 1.0 = 80

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

80 X 0.75 = 60

# HAZARDOUS ASSESSMENT RATING FORM



NAME OF SITE Fire Training Area No. 3

LOCATION Buckley ANGB, 5th and G Streets

DATE OF OPERATION OR OCCURRENCE 1972-1982

OWNER/OPERATOR Buckley Fire Department

COMMENTS/DESCRIPTION Fuels burning area

SITE RATED BY TCF

## I. RECEPTORS

| Rating Factor | Factor Rating (0-3) | Multiplier | Factor Score | Maximum Possible Score |
|---|---|---|---|---|
| A. Population within 1,000 feet of site | 3 | 4 | 12 | 12 |
| B. Distance to nearest well | 1 | 10 | 10 | 30 |
| C. Land use/zoning within 1 mile radius | 2 | 3 | 6 | 9 |
| D. Distance to reservation boundary | 3 | 6 | 18 | 18 |
| E. Critical environments within 1 mile radius of site | 1 | 10 | 10 | 30 |
| F. Water quality of nearest surface water body | 1 | 6 | 6 | 18 |
| G. Ground water use of uppermost aquifer | 2 | 9 | 18 | 27 |
| H. Population served by surface water supply within 3 miles downstream of site | 0 | 6 | 0 | 18 |
| I. Population served by ground-water supply within 3 miles of site | 1 | 6 | 6 | 18 |
| | | Subtotals | 86 | 180 |

Receptors subscore (100 X factor score subtotal/maximum score subtotal) 48

## II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) L
2. Confidence level (C = confirmed, S = suspected) C
3. Hazard rating (H = high, M = medium, L = low) H

Factor Subscore A (from 20 to 100 based on factor score matrix) 100

B. Apply persistence factor
Factor Subscore A X Persistence Factor = Subscore B

100 X 0.8 = 80

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

80 x 1.0 = 80

# HAZARDOUS ASSESSMENT RATING FORM



NAME OF SITE Fire Training Area No. 1

LOCATION Buckley ANGB, near reservoir

DATE OF OPERATION OR OCCURRENCE 1946(?) - 1950

OWNER/OPERATOR Buckley Fire Department

COMMENTS/DESCRIPTION Avgas burning area

SITE RATED BY TCF

## I. RECEPTORS

| Rating Factor | Factor Rating (0-3) | Multiplier | Factor Score | Maximum Possible Score |
|---|---|---|---|---|
| A. Population within 1,000 feet of site | 1 | 4 | 4 | 12 |
| B. Distance to nearest well | 3 | 10 | 30 | 30 |
| C. Land use/zoning within 1 mile radius | 1 | 3 | 3 | 9 |
| D. Distance to reservation boundary | 2 | 6 | 12 | 18 |
| E. Critical environments within 1 mile radius of site | 2 | 10 | 20 | 30 |
| F. Water quality of nearest surface water body | 1 | 6 | 6 | 18 |
| G. Ground water use of uppermost aquifer | 2 | 9 | 18 | 27 |
| H. Population served by surface water supply within 3 miles downstream of site | 0 | 6 | 0 | 18 |
| I. Population served by ground-water supply within 3 miles of site | 1 | 6 | 6 | 18 |
| | | Subtotals | 99 | 180 |

Receptors subscore (100 X factor score subtotal/maximum score subtotal) 55

## II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) S
2. Confidence level (C = confirmed, S = suspected) S
3. Hazard rating (H = high, M = medium, L = low) H

Factor Subscore A (from 20 to 100 based on factor score matrix) 40

B. Apply persistence factor
Factor Subscore A X Persistence Factor = Subscore B

40 x 1.0 = 40

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

40 x 1.0 = 40

# HAZARDOUS ASSESSMENT RATING FORM



NAME OF SITE Storm Drainage System

LOCATION Buckley ANGB, near Building 801

DATE OF OPERATION OR OCCURRENCE 1942 - 1982

OWNER/OPERATOR Buckley ANGB

COMMENTS/DESCRIPTION

SITE RATED BY TCF

## I. RECEPTORS

| Rating Factor | Factor Rating (0-3) | Multiplier | Factor Score | Maximum Possible Score |
|---|---|---|---|---|
| A. Population within 1,000 feet of site | 3 | 4 | 12 | 12 |
| B. Distance to nearest well | 1 | 10 | 10 | 30 |
| C. Land use/zoning within 1 mile radius | 2 | 3 | 6 | 9 |
| D. Distance to reservation boundary | 3 | 6 | 18 | 18 |
| E. Critical environments within 1 mile radius of site | 1 | 10 | 10 | 30 |
| F. Water quality of nearest surface water body | 1 | 6 | 6 | 18 |
| G. Ground water use of uppermost aquifer | 2 | 9 | 18 | 27 |
| H. Population served by surface water supply within 3 miles downstream of site | 0 | 6 | 0 | 18 |
| I. Population served by ground-water supply within 3 miles of site | 1 | 6 | 6 | 18 |
| | | Subtotals | 86 | 180 |

Receptors subscore (100 X factor score subtotal/maximum score subtotal) 48

## II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) S
2. Confidence level (C = confirmed, S = suspected) S
3. Hazard rating (H = high, M = medium, L = low) H

Factor Subscore A (from 20 to 100 based on factor score matrix) 40

B. Apply persistence factor
Factor Subscore A X Persistence Factor = Subscore B

40 X 1.0 = 40

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

40 X 1.0 = 40

# HAZARDOUS ASSESSMENT RATING FORM



NAME OF SITE Sludge Drying Beds

LOCATION Buckley ANGB, Sewage Treatment Plant

DATE OF OPERATION OR OCCURRENCE 1942 - 1978

OWNER/OPERATOR Buckley Civil Engineering Department

COMMENTS/DESCRIPTION

SITE RATED BY TCF

## I. RECEPTORS

| Rating Factor | Factor Rating (0-3) | Multiplier | Factor Score | Maximum Possible Score |
|---|---|---|---|---|
| A. Population within 1,000 feet of site | 2 | 4 | 8 | 12 |
| B. Distance to nearest well | 3 | 10 | 30 | 30 |
| C. Land use/zoning within 1 mile radius | 3 | 3 | 9 | 9 |
| D. Distance to reservation boundary | 3 | 6 | 18 | 18 |
| E. Critical environments within 1 mile radius of site | 0 | 10 | 0 | 30 |
| F. Water quality of nearest surface water body | 1 | 6 | 6 | 18 |
| G. Ground water use of uppermost aquifer | 2 | 9 | 18 | 27 |
| H. Population served by surface water supply within 3 miles downstream of site | 0 | 6 | 0 | 18 |
| I. Population served by ground-water supply within 3 miles of site | 1 | 6 | 6 | 18 |
| | | Subtotals | 95 | 180 |

Receptors subscore (100 X factor score subtotal/maximum score subtotal) 53

## II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) S
2. Confidence level (C = confirmed, S = suspected) S
3. Hazard rating (H = high, M = medium, L = low) H

Factor Subscore A (from 20 to 100 based on factor score matrix) 40

B. Apply persistence factor
Factor Subscore A X Persistence Factor = Subscore B

40 X 0.75 = 30

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

40 X 0.75 = 30

# HAZARDOUS ASSESSMENT RATING FORM



NAME OF SITE Army Aircraft Burial Site

LOCATION Buckley ANGB, East of Control Tower

DATE OF OPERATION OR OCCURRENCE 1942 - 1945

OWNER/OPERATOR Army Air Force

COMMENTS/DESCRIPTION

SITE RATED BY TCF

## I. RECEPTORS

| Rating Factor | Factor Rating (0-3) | Multiplier | Factor Score | Maximum Possible Score |
|---|---|---|---|---|
| A. Population within 1,000 feet of site | 1 | 4 | 4 | 12 |
| B. Distance to nearest well | 3 | 10 | 30 | 30 |
| C. Land use/zoning within 1 mile radius | 1 | 3 | 3 | 9 |
| D. Distance to reservation boundary | 2 | 6 | 12 | 18 |
| E. Critical environments within 1 mile radius of site | 2 | 10 | 20 | 30 |
| F. Water quality of nearest surface water body | 1 | 6 | 6 | 18 |
| G. Ground water use of uppermost aquifer | 2 | 9 | 18 | 27 |
| H. Population served by surface water supply within 3 miles downstream of site | 0 | 6 | 0 | 18 |
| I. Population served by ground-water supply within 3 miles of site | 1 | 6 | 6 | 18 |
| | | Subtotals | 99 | 180 |

Receptors subscore (100 X factor score subtotal/maximum score subtotal) 55

## II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) S
2. Confidence level (C = confirmed, S = suspected) S
3. Hazard rating (H = high, M = medium, L = low) L

Factor Subscore A (from 20 to 100 based on factor score matrix) 20

B. Apply persistence factor
Factor Subscore A X Persistence Factor = Subscore B

20 X 1.0 = 20

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

20 X 0.5 = 10

# APPENDIX K

# GLOSSARY OF TERMINOLOGY AND ABBREVIATIONS

APPENDIX K

GLOSSARY OF TERMINOLOGY AND ABBREVIATIONS

AFB: Air Force Base

AGE: Aerospace Ground Equipment

ANG: Air National Guard

ANGB: Air National Guard Base

ARTESIAN: Groundwater contained under hydrostatic pressure

AQUIFER: A geologic formation, group of formations, or part of a formation that is capable of yielding water to a well or spring

AVGAS: Aviation gasoline

BIOACCUMULATE: Tendency of elements or compounds to accumulate or build up in the tissues of living organisms when they are exposed to these elements in their environments, e.g., heavy metals

CERCLA: Comprehensive Environmental Response, Compensation and Liability Act

CES: Civil Engineering Squadron

COD: Chemical Oxygen Demand, a measure of the amount of oxygen required to oxidize organic and oxidizable inorganic compounds in water

CONTAMINATION: The degradation of natural water quality to the extent that its usefulness is impaired; there are no implications of any specific limits because the degree of permissible contamination depends upon the intended end use or uses of the water

DET: Detachment

DISPOSAL FACILITY: A facility or part of a facility at which hazardous waste is intentionally placed into or on land or water, and at which waste will remain after closure

DISPOSAL OF HAZARDOUS WASTE: The discharge, deposit, injection, dumping, spilling, or placing of any hazardous waste into or on land or water so that such waste or any constituent thereof may enter the environment or be emitted into the air or discharged into any waters, including groundwater

DOD: Department of Defense

DOWN-GRADIENT: In the direction of decreasing hydraulic static head; the direction in which groundwater flows

DPDO: Defense Property Disposal Office, previously included R & M, Redistribution and Marketing

manner that the likelihood of contamination of groundwater or escape of the substance into the environment is increased, any other reaction which might result in not meeting the Air, Human Health, and Environmental Standard

INFILTRATION: The flow of liquid through pores or small openings

IRP: Installation Restoration Program

JP-4: Jet fuel

LEACHATE: A solution resulting from the separation or dissolving of soluble or particulate constituents from solid waste or other man-placed medium by percolation of water

LEACHING: The process by which soluble materials in the soil, such as nutrients, pesticide chemicals, or contaminants, are washed into a lower layer of soil or are dissolved and carried away by water

LINER: A continuous layer of natural or man-made materials beneath or on the sides of a surface impoundment, landfill, or landfill cell which restricts the downward or lateral escape of hazardous waste, hazardous waste constituents, or leachate

RCRA: Resource Conservation and Recovery Act

SLUDGE: The solid residue resulting from a manufacturing or wastewater treatment process which also produces a liquid stream

SOLID WASTE: Any garbage, refuse, or sludge from a waste treatment plant, water supply treatment, or air pollution control facility and other discarded material, including solid, liquid, semi-solid, or contained gaseous material resulting from industrial, commercial, mining, or agricultural operations and from community activities, but does not include solid or dissolved materials in domestic sewage; solid or dissolved materials in irrigation return flows; industrial discharges which are point source subject to permits under Section 402 of the Federal Water Pollution Control Act, as amended (86 USC 880); or source, special nuclear, or by-product material as defined by the Atomic Energy Act of 1954 (68 USC 923)

SPILL: Any unplanned release or discharge of a hazardous waste onto or into the air, land, or water

STORAGE OF HAZARDOUS WASTE: Containment, either on a temporary basis or for a longer period, in such a manner as not to constitute disposal of such hazardous waste

TAC: Tactical Air Command

TOXICITY: The ability of a material to produce injury or disease upon exposure, ingestion, inhalation, or assimilation by a living organism

TREATMENT OF HAZARDOUS WASTE: Any method, technique, or process including neutralization designed to change the physical, chemical, or biological

# LABORATORY ANALYSIS RECORD

14 Sep 81

TO:

FROM: USAF OEHL/SA
Brooks AFB TX 78235

SAMPLE IDENTITY
TRANSFORMER OILS

DATE RECEIVED
16 Jul 81

SAMPLE FROM

LAB CONTROL NUMBER
SEE OEHL NO BELOW

TEST FOR
POLYCHLORINATED BIPHENYLS *(PCBs)*

METHODOLOGY
GAS CHROMATOGRAPHY *(GC)*

| OEHL NUMBER | BASE NUMBER | PPM |
|---|---|---|
| 28485 | 47 | ND<6 |
| 28486 | 48 | ND<6 |
| 28487 | 49 | ND<6 |
| 28488 | 50 | ND<6 |
| 28489 | 51 | ND<6 |
| 28490 | 52 | TR<12 |
| 28491 | 53 | ND<6 |
| 28492 | 54 | ND<6 |
| 28493 | 55 | ND<6 |
| 28494 | 56 | ND<6 |
| 28495 | 57 | ND<6 |
| 28496 | 58 | ND<6 |
| 28497 | 59 | ND<6 |
| 28498 | 60 | ND<6 |
| 28499 | 61 | ND<6 |

COMMENTS

ND - None detected. Less than the detection limit.
Trace - Present but less than the quantitative limit.

REQUESTING AGENCY *(Mailing Address)*

140 TAC Hosp/SGP
Buckley Ang Base
Aurora CO 80011



OEHL FORM

# PCB LABORATORY ANALYSIS RECORD

TO:

FROM: USAF OEHL/SA
Brooks AFB TX 78235

SAMPLE IDENTITY
TRANSFORMER OILS

DATE RECEIVED

SAMPLE FROM

LAB CONTROL NUMBER

TEST FOR
POLYCHLORINATED BIPHENYLS *(PCBs)*

METHODOLOGY
GAS CHROMATOGRAPHY *(GC)*

| OEHL NUMBER | BASE NUMBER | PPM |
|---|---|---|
| 28515 | 77 | ND<6 |
| 28516 | 78 | ND<6 |
| 28517 | 79 | ND<6 |
| 28518 | 81 | ND<6 |
| 28519 | 82 | ND<6 |
| 28520 | 83 | ND<6 |
| 28521 | 84 | TR<12 |
| 28522 | 85 | ND<6 |
| 28523 | 86 | ND<6 |
| 28524 | 87 | ND<6 |
| 28525 | 88 | ND<6 |
| 28526 | 89 | ND<6 |
| 28527 | 90 | ND<6 |
| 28528 | 91 | ND<6 |
| 28529 | 92 | ND<6 |

COMMENTS

ND - None detected. Less than the detection limit.
Trace - Present but less than the quantitative limit.

REQUESTING AGENCY *(Mailing Address)*



OEHL FORM 4

PCB

# PCB LABORATORY ANALYSIS RECORD

DATE

TO:

FROM: USAF OEHL/SA
Brooks AFB TX 78235

SAMPLE IDENTITY
TRANSFORMER OILS

DATE RECEIVED

SAMPLE FROM

LAB CONTROL NUMBER

TEST FOR
POLYCHLORINATED BIPHENYLS *(PCBs)*

METHODOLOGY
GAS CHROMATOGRAPHY *(GC)*

| OEHL NUMBER | BASE NUMBER | PPM |
|---|---|---|
| 28545 | 15 | ND<6 |
| 28546 | 16 | ND<6 |
| 28547A | 17A | ND<6 |
| 28547B | 17B | ND<6 |
| 28548 | 18 | ND<6 |
| 28549 | 19 | NO SAMPLE RECEIVED |
| 28550 | 20 | ND<6 |
| 28551 | 21 | ND<6 |
| 28552 | 22 | ND<6 |
| 28553 | 23 | ND<6 |
| 28554 | 24 | TR<12 |
| 28555 | 25 | NO SAMPLE RECEIVED |
| 28556 | 26 | TR<12 |
| 28557 | 27 | ND<6 |
| 28558 | 28 | ND<6 |

COMMENTS

ND - None detected. Less than the detection limit.
Trace - Present but less than the quantitative limit.

REQUESTING AGENCY *(Mailing Address)*



OEHL FORM

# PCB LABORATORY ANALYSIS RECORD

DATE:

TO:

FROM: USAF OEHL/SA
Brooks AFB TX 78235

SAMPLE IDENTITY: TRANSFORMER OILS

DATE RECEIVED:

SAMPLE FROM:

LAB CONTROL NUMBER:

TEST FOR: POLYCHLORINATED BIPHENYLS *(PCBs)*

METHODOLOGY: GAS CHROMATOGRAPHY *(GC)*

| OEHL NUMBER | BASE NUMBER | PPM |
|---|---|---|
| 28574 | 44 | ND<6 |
| 28575A | 45A | 25 |
| 28575B | 45B | 20 |
| 28576 | 46 | 17 |
| 28636 | 9293337 | ND<6 |
| 28637 | 18742 | ND<6 |
| 28638 | 11602 | ND<6 |
| 28639 | 793-94 | ND<6 |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

COMMENTS

LEOPOLDO L. RODRIGUEZ, GS12
Trace Organics Analysis Function
Environmental Chemistry Branch

ADRIAN SANCHEZ, GS9, Technician
Trace Organics Analysis Function
Environmental Chemistry Branch

ND - None detected. Less than the detection limit.
Trace - Present but less than the quantitative limit.

REQUESTING AGENCY *(Mailing Address)*

END
FILMED
9/88
DTIC

OFFICE COPY